Attachment 1-1

(AES Indiana’s Non-Technical Summary)
2022 Integrated Resource Plan (IRP)

Non-Technical Summary
**Background**

AES Indiana generates, transmits, distributes and sells electricity to approximately 517,000 retail customers in Indianapolis and neighboring areas, the most distant point being about 40 miles from Indianapolis. In total, AES Indiana’s service area covers about 528 square miles.

AES Indiana is subject to the regulatory authority of the Indiana Utility Regulatory Commission (“IURC”) and the Federal Energy Regulatory Commission (“FERC”). AES Indiana fully participates in the electricity markets managed by the Midcontinent Independent System Operator (“MISO”). AES Indiana is a transmission company member of Reliability First (“RF”). RF is one of eight Regional Reliability Councils under the North American Reliability Corporation (“NERC”), which has been designated as the Electric Reliability Organization under the EPAct.

AES Indiana is part of the AES Corporation, a Fortune 500 global power company, with a mission to improve lives by accelerating the future of energy, together.

The Integrated Resource Plan (“IRP”) is viewed as a guide for future resource decisions made at a snapshot in time. Resource decisions, particularly those beyond the five-year horizon, are subject to change based on future analyses and regulatory filings. Any new resource additions, including supply-side and demand-side resources, will be submitted for regulatory approval as necessary or appropriate.

**Energy mix values**

<table>
<thead>
<tr>
<th></th>
<th>2023</th>
<th>2032</th>
<th>2042</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>50%</td>
<td>46%</td>
<td>13%</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>42%</td>
<td>17%</td>
<td>46%</td>
</tr>
<tr>
<td>Wind</td>
<td>5%</td>
<td>31%</td>
<td>32%</td>
</tr>
<tr>
<td>Solar+ Storage</td>
<td>3%</td>
<td>7%</td>
<td>8%</td>
</tr>
<tr>
<td>DSM</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3,634 Total MW of Generation

- **Harding Street Station, Georgetown Station, Solar REP Projects – 1,208 MW**
- **Eagle Valley Generating Station – 671 MW**
- **Hoosier Wind Park PPA – 100 MW**
- **Hardy Hills 195 MW Solar COD 2023**
- **Petersburg Energy Center 250MW Solar + 45MW 4-hour BESS COD 2024**
- **Petersburg Generating Station – 1,455 MW**

*Lakefield Wind Park PPA – 200 MW (in MN, not pictured)
Meeting Our Customers’ Needs Today and Tomorrow

AES Indiana is leading the inclusive, clean energy transition.
Preferred Resource Portfolio and Short Term Action Plan

AES Indiana’s 2022 Integrated Resource Plan was developed in an environment with unprecedented market changes that created new challenges for long-range planning. Specifically, the approval of MISO’s Seasonal Resource Adequacy Construct, the passage of the Inflation Reduction Act, volatile commodity prices for power and fuels, inflated costs for replacements resources, and scarcity within the NOx allowance market have all influenced AES Indiana’s strategy and process for this IRP.

Through a transparent planning and stakeholder engagement process that addressed the noted challenges and a comprehensive evaluation of seventeen (17) Scorecard metrics, AES Indiana selected a Preferred Resource Portfolio and Short Term Action Plan that provides affordable, reliable, and sustainable energy for its customers.

AES Indiana’s Preferred Resource Portfolio and Short Term Action Plan will:

1) Add Renewables
   Add up to 1,300 MW of wind, solar and storage by 2027

After refueling Petersburg Units 3 and 4 to natural gas, AES Indiana still has a 240 MW winter capacity need starting in 2025 due to MISO’s new Seasonal Resource Adequacy Construct. Modeling results indicate that, after including the ITC benefits for standalone storage that were included in the Inflation Reduction Act provisions, battery energy storage is the most cost-effective capacity resource to fill this need. Additionally, the model indicated that an additional 500 to 1,065 MW of wind and solar resources are needed to cost effectively replace some of the energy value provided by Petersburg as a coal resource.

2) Convert
   Convert Petersburg units 3 and 4 (1,052 MW) to natural gas in 2025 via existing pipeline on site

Based on extensive modeling, AES Indiana has determined that the conversion of the Company’s remaining coal units from coal to natural gas provides customers with a strategy that can reliably meet capacity obligations in MISO Seasonal Resource Adequacy Construct. Additionally, converting these units provides customers economic savings.

3) Monitor
   Monitor emerging technologies for inclusion in future planning

Beyond the three to five-year Short Term Action Plan which includes the items mentioned above, AES Indiana intends to closely monitor new and emerging technologies that could serve as viable clean energy options for future IRP planning. More specifically, the Company is closely following progress made in new technologies like longer duration storage coupled with solar, clean hydrogen and small modular reactors that could serve as reliable capacity in future years. If these technologies are deemed cost effective and viable, the Company will include them as replacement options in future Integrated Resource Plans.

Note: Additionally, the plan includes a three-year DSM action plan that targets an annual average of 130,000 to 134,000 MWh of energy efficiency (approximately 1.1% of 2021 sales) and three-year total of 53 MW summer peak impacts of demand response.
Short Term Action Plan Best Serves Our Customers’ Objectives

1. **Reliability**
   - Highest composite reliability score

2. **Affordability**
   - Saves AES Indiana customers more than $200M

3. **Sustainability**
   - Provides 68% reduction in carbon intensity in 2030 compared to 2018
IRP Objective

The objective of AES Indiana’s IRP is to identify a preferred resource portfolio that provides safe, reliable, sustainable, and reasonable least cost energy service to AES Indiana customers, giving due consideration to potential risks and stakeholder input. The study period for this IRP is 2023 through 2042.

IRP Process

Every three years, AES Indiana submits an Integrated Resource Plan to the IURC in accordance with Indiana Administrative Code (IAC 170 4-7). The IRP describes expected electrical load requirements, discusses potential risks, possible future scenarios and defines a preferred resource portfolio to meet those requirements over a forward-looking 20-year study period based upon analysis of all factors. This process includes extensive collaboration with stakeholders known as a “Public Advisory” process.

Public Advisory Process

AES Indiana hosted five (5) public advisory meetings and five (5) technical meetings to discuss the IRP process with interested parties and solicit feedback from stakeholders. The meeting agendas from each meeting are highlighted here.

For all meeting notes, presentations and other materials, see AES Indiana’s IRP webpage at aesindiana.com/irp. AES Indiana incorporated feedback from stakeholders to shape the scenarios, develop metrics, and clarify the data presented.

Stakeholder and public input process

Public advisory meetings were held virtually via Microsoft Teams and attended by stakeholders, AES Indiana employees and members of the public.

<table>
<thead>
<tr>
<th>Public Advisory Meeting #1</th>
<th>Public Advisory Meeting #2</th>
<th>Public Advisory Meeting #3</th>
<th>Public Advisory Meeting #4</th>
<th>Public Advisory Meeting #5</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 24, 2021</td>
<td>April 12, 2021</td>
<td>June 27, 2021</td>
<td>September 19, 2021</td>
<td>October 31, 2021</td>
</tr>
<tr>
<td><strong>Topics covered:</strong> 2019 IRP recap, 2022 IRP planning and model overview, overview of existing resources, baseline energy and load forecast, electric vehicle and solar PV forecasts, introduction to demand-side management market potential study.</td>
<td><strong>Topics covered:</strong> load scenarios, market potential study results and demand-side management resources, replacement resource assumptions, scenario framework and portfolio matrix.</td>
<td><strong>Topics covered:</strong> stakeholder presentations, 2022 All-Source RFP and replacement resource cost update, commodity forecasts, RTO reliability planning, modeling reliability assumptions, reliability analysis, portfolio metrics and scorecard, distribution system planning.</td>
<td><strong>Topics covered:</strong> summary of 2022 short term action plan, analysis of preferred resource portfolio and alternatives.</td>
<td><strong>Topics covered:</strong></td>
</tr>
</tbody>
</table>
2022 IRP Framework

AES Indiana utilized a portfolio matrix scenario framework that evaluated five predefined strategies and one optimization (allowed the planning model to economically select a portfolio without a strategy predefined).

**The five predefined strategies included:**

1. Operating the remaining Petersburg Generating Station (Petersburg) coal units 3 and 4 on coal through the remainder of its useful life
2. Converting Petersburg units 3 and 4 to natural gas in 2025
3. Retiring Petersburg Unit 3 in 2026 and leaving Petersburg Unit 4 on coal through the remainder of its useful life
4. Retiring both Petersburg Units 3 and 4 in 2026 and 2028
5. Retiring both Petersburg units 3 and 4 in 2026 and 2028 and replacing them with wind solar and storage

**These five strategies and sixth optimization were optimized across four different scenarios that included a range of environmental policy assumptions:**

1. No Environmental Action – included relaxed environmental regulation and no subsidies for renewables
2. Current Trends/Reference Case – included the most likely future environmental regulations including renewable subsidies contained in the Inflation Reduction Act
3. Aggressive Environmental – included a carbon tax starting in 2028 at $19.47/ton
4. Decarbonized Economy – included a Renewable Portfolio Standard that requires utilities to transition supplying most of the energy from clean energy sources by 2042

**Portfolio matrix**

Results from the scenario analysis show that converting Petersburg to natural gas in 2025 is the reasonable least cost strategy for customers – particularly in the Current Trends/Reference Case scenario which provides the most likely representation of the future.

Note: Candidate Portfolios evaluated on the IRP Scorecard

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### Portfolio matrix**

<table>
<thead>
<tr>
<th>Strategies</th>
<th>No Environmental Action</th>
<th>Current Trends (Reference Case)</th>
<th>Aggressive Environmental</th>
<th>Decarbonized Economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: No Early Retirement</td>
<td>$7,111</td>
<td></td>
<td>$9,572</td>
<td>$11,349</td>
</tr>
<tr>
<td>2: Petersburg Conversion (est. 2025)</td>
<td>$6,621</td>
<td></td>
<td>$9,330</td>
<td>$11,181</td>
</tr>
<tr>
<td>3: One Petersburg Unit Retires (2026)</td>
<td>$7,462</td>
<td></td>
<td>$9,773</td>
<td>$11,470</td>
</tr>
<tr>
<td>4: Both Petersburg Units Retire (2026 &amp; 2028)</td>
<td>$7,425</td>
<td></td>
<td>$9,618</td>
<td>$11,145</td>
</tr>
<tr>
<td>5: Clean Energy Strategy</td>
<td>$9,211</td>
<td></td>
<td>$9,711</td>
<td>$11,184</td>
</tr>
<tr>
<td>6: Encompass Optimization</td>
<td>$6,610</td>
<td></td>
<td>$9,262</td>
<td>$10,994</td>
</tr>
</tbody>
</table>

20-Year PVRR (2023$MM, 2023-2042)
## Scorecard Evaluation & Results Summary

AES Indiana conducted a robust Scorecard Evaluation of the Current Trends/Reference Case strategies (Candidate Portfolios) to select the Preferred Resource Portfolio and Short Term Action Plan.

In the Scorecard Evaluation, the Company evaluated the Candidate Portfolios using five categories that address critical utility planning considerations. These include the Five Pillars of Electric Service as defined by the 21st Century Energy Policy Development Task Force of Affordability, Sustainability, Reliability, Resiliency and Stability. Additionally, the Company included metric categories for Risks & Opportunities and Economic Impacts.

### Strategies

<table>
<thead>
<tr>
<th>Strategies</th>
<th>1: No Early Retirement</th>
<th>2: Pete Refuel to 100% Gas (est. 2025)</th>
<th>3: One Pete Unit Retires (2026)</th>
<th>4: Both Pete Units Retire (2026 &amp; 2028)</th>
<th>5: Clean Energy Strategy</th>
<th>6: Encompass Optimization</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-yr PVRR CO2 Emissions</td>
<td>101.9</td>
<td>93.30</td>
<td>93.77</td>
<td>92.18</td>
<td>88.73</td>
<td>92.62</td>
</tr>
<tr>
<td>Total portfolio CO2 Emissions (tons)</td>
<td>64,991</td>
<td>13,513</td>
<td>45,544</td>
<td>25,649</td>
<td>25,383</td>
<td>18,622</td>
</tr>
<tr>
<td>20-yr PVRR SO2 Emissions</td>
<td>45,605</td>
<td>22,146</td>
<td>42,042</td>
<td>24,932</td>
<td>24,881</td>
<td>25,645</td>
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<tr>
<td>Total portfolio SO2 Emissions (tons)</td>
<td>36.7</td>
<td>7.9</td>
<td>26.7</td>
<td>15.0</td>
<td>14.8</td>
<td>10.9</td>
</tr>
<tr>
<td>20-yr PVRR NOX Emissions</td>
<td>6,611</td>
<td>1,417</td>
<td>4,813</td>
<td>2,700</td>
<td>2,676</td>
<td>1,970</td>
</tr>
<tr>
<td>Total portfolio NOX Emissions (tons)</td>
<td>45%</td>
<td>55%</td>
<td>52%</td>
<td>48%</td>
<td>64%</td>
<td>54%</td>
</tr>
<tr>
<td>Water Use CCP (tons)</td>
<td>7.96</td>
<td>7.95</td>
<td>7.86</td>
<td>7.90</td>
<td>7.57</td>
<td>7.95</td>
</tr>
<tr>
<td>% Renewable Energy in 2032</td>
<td>45%</td>
<td>55%</td>
<td>52%</td>
<td>48%</td>
<td>64%</td>
<td>54%</td>
</tr>
<tr>
<td>Composite score from Reliability Analysis</td>
<td>7.95</td>
<td>7.95</td>
<td>7.86</td>
<td>7.90</td>
<td>7.57</td>
<td>7.95</td>
</tr>
<tr>
<td>Lowest PVRR across policy scenarios ($000,000)</td>
<td>$8,860</td>
<td>$8,564</td>
<td>$9,288</td>
<td>$9,315</td>
<td>$9,590</td>
<td>$8,557</td>
</tr>
<tr>
<td>Highest PVRR across policy scenarios ($000,000)</td>
<td>$11,209</td>
<td>$11,329</td>
<td>$11,462</td>
<td>$11,392</td>
<td>$11,275</td>
<td>$11,226</td>
</tr>
<tr>
<td>P5 (Mean-P)</td>
<td>$9,271</td>
<td>$9,030</td>
<td>$9,606</td>
<td>$9,295</td>
<td>$9,947</td>
<td>$8,952</td>
</tr>
<tr>
<td>PS5 [P95 - Mean]</td>
<td>$9,840</td>
<td>$9,746</td>
<td>$10,237</td>
<td>$9,903</td>
<td>$10,039</td>
<td>$9,629</td>
</tr>
<tr>
<td>Portfolio PVRW w/ low renewable cost ($000,000)</td>
<td>$10,157</td>
<td>$8,763</td>
<td>$9,244</td>
<td>$9,104</td>
<td>$10,406</td>
<td>$8,730</td>
</tr>
<tr>
<td>Portfolio PVRW w/ high renewable cost ($000,000)</td>
<td>$11,259</td>
<td>$9,999</td>
<td>$10,466</td>
<td>$10,249</td>
<td>$9,999</td>
<td>$9,999</td>
</tr>
<tr>
<td>20-year avg sales + purchases (GWh)</td>
<td>222</td>
<td>99</td>
<td>195</td>
<td>74</td>
<td>55</td>
<td>88</td>
</tr>
<tr>
<td>Present Value of Revenue Requirements ($000,000)</td>
<td>$[$264]</td>
<td>$[$334]</td>
<td>$[$336]</td>
<td>$[$287]</td>
<td>$[$312]</td>
<td>$[$352]</td>
</tr>
<tr>
<td>Total FTEs associated with generation</td>
<td>$[$280]</td>
<td>$[$321]</td>
<td>$[$242]</td>
<td>$[$256]</td>
<td>$[$256]</td>
<td>$[$256]</td>
</tr>
<tr>
<td>Total amount of property tax paid from AES IN assets ($000,000)</td>
<td>$154</td>
<td>$193</td>
<td>$204</td>
<td>$242</td>
<td>$256</td>
<td>$185</td>
</tr>
</tbody>
</table>

### LEAST COST

1: No Early Retirement

2: Pete Refuel to 100% Gas (est. 2025)

3: One Pete Unit Retires (2026)

4: Both Pete Units Retire (2026 & 2028)

5: Clean Energy Strategy

6: Encompass Optimization

### HIGHEST COST

1: No Early Retirement

2: Pete Refuel to 100% Gas (est. 2025)

3: One Pete Unit Retires (2026)

4: Both Pete Units Retire (2026 & 2028)

5: Clean Energy Strategy

6: Encompass Optimization
**Affordability**

The Scorecard Evaluation demonstrated that the Petersburg conversion provides the most affordable strategy for AES Indiana customers by exhibiting the lowest 20-year Present Value of Revenue Requirements (PVRR) and lowest annual revenue requirement volatility over the 20-year planning period.

**Sustainability**

Additionally, the Scorecard Evaluation demonstrated that the Petersburg conversion provides the lowest SO2, NOX, water use and coal production product emissions and the second lowest CO2 emissions over the 20-year planning period making it the best performing strategy in the Sustainability category. The chart at right shows that the Petersburg conversion will provide a 69% reduction in CO2 emission by 2030 compared to 2018 levels.

AES Indiana will achieve a 68% reduction in carbon intensity by 2030 compared to 2018 levels.
Reliability, Resiliency and Stability

To measure Reliability in the Scorecard Evaluation, AES Indiana consulted with Quanta Technology to perform a reliability analysis of the Candidate Portfolios.

Quanta evaluated nine different reliability categories including Energy Adequacy, Operational Flexibility and Frequency Support, Short Circuit Strength Requirement, Power Quality (Flicker), Blackstart, Dynamic VAR Support, Dispatchability and Automatic Generation Control, Predictability and Firmness of Supply, and Geographic Location Relative to Load (resilience). Quanta created a Composite reliability score from these nine categories to evaluate the Candidate Portfolios.

Their analysis demonstrated that the Petersburg conversion performed the best among the Candidate Portfolios by maintaining Petersburg as a dispatchable resource.

Risk & Opportunities

The Scorecard also evaluated the Candidate Portfolios for the Risk & Opportunity associated with changing environmental policies, volatile commodities, market interaction & exposure, and fluctuating renewable resource costs. This evaluation included a stochastic analysis that ran 100 simulations of power prices, gas prices, coal prices, load, and renewable generation.

The Petersburg conversion performed the best overall across the Risk & Opportunity metrics that were considered.

Economic Impacts

Finally, the Scorecard considered the Economic Impacts from the Candidate Portfolios.

The evaluation determined that the Petersburg conversion will continue to contribute economically to the Petersburg community by leveraging existing infrastructure and maintaining operation of the Petersburg Generating Station as a gas resource and hub for renewable resources.
Attachment 1-2

(AES Indiana’s Public Advisory Meeting Presentations)
2022 Integrated Resource Plan (IRP)

Public Advisory Meeting #1
1/24/2022
Agenda and Introductions

Stewart Ramsay, Managing Executive, Vanry & Associates
<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>Speakers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morning Starting at 10:00 AM</td>
<td>Safety and Virtual Meeting Schedule and Protocols</td>
<td>Chad Rogers, Senior Manager, Regulatory Affairs, AES Indiana Brandi Davis-Handy, Chief Public Relations Officer, AES US Utilities</td>
</tr>
<tr>
<td></td>
<td>Welcome and Overview of AES Indiana</td>
<td>Kristina Lund, President &amp; CEO, AES US Utilities</td>
</tr>
<tr>
<td></td>
<td>IRP Planning and Model Overview</td>
<td>Erik Miller, Manager, Resource Planning, AES Indiana Will Vance, Senior Analyst, AES Indiana</td>
</tr>
<tr>
<td></td>
<td>2019 IRP Recap</td>
<td>Aaron Cooper, Chief Commercial Officer, AES US Utilities Erik Miller, Manager, Resource Planning, AES Indiana</td>
</tr>
<tr>
<td></td>
<td>Overview of Existing Resources, Replacement Resource Options and Future IRPs</td>
<td>Aaron Cooper, Chief Commercial Officer, AES US Utilities Erik Miller, Manager, Resource Planning, AES Indiana</td>
</tr>
<tr>
<td>Break 11:45 AM – 12:15 PM</td>
<td>Lunch</td>
<td></td>
</tr>
<tr>
<td>Afternoon Starting at 12:15 PM</td>
<td>Baseline Energy and Load Forecast</td>
<td>Eric Fox, Director, Forecasting Solutions, Itron Mike Russo, Forecast Consultant, Itron</td>
</tr>
<tr>
<td></td>
<td>Electric Vehicle (EV) and Solar PV Forecasts</td>
<td>Jordan Janfione, EV Modeling Forecasting, GDS Associates Patrick Burns, PV Modeling Lead and Regulatory/IRP Support, Brightline Group</td>
</tr>
<tr>
<td></td>
<td>DSM Market Potential Study Introduction</td>
<td>Jeffrey Huber, Overall Project Manager and MPS Lead, GDS Associates Jacob Thomas, Market Research and End-Use Analysis Lead, GDS Associates Melissa Young, Demand Response Lead, GDS Associates</td>
</tr>
</tbody>
</table>
Virtual Meeting Protocols and Safety

Brandi Davis-Handy, Chief Public Relations Officer, AES US Utilities
Chad Rogers, Senior Manager, Regulatory Affairs, AES Indiana
IRP Team Introductions

AES Indiana Leadership Team
Aaron Cooper, Chief Commercial Officer, AES US Utilities
Brandi Davis-Handy, Chief Public Relations Officer, AES US Utilities
Kristina Lund, President & CEO, AES US Utilities
Wendy Mehringer, Chief Customer Officer, AES US Utilities
Judi Sobecki, General Counsel and Chief Regulatory Officer, AES US Utilities

AES Indiana IRP Planning Team
Joe Bocanegra, Load Forecasting Analyst, AES Indiana
Erik Miller, Manager, Resource Planning, AES Indiana
Scott Perry, Manager, Regulatory Affairs, AES Indiana
Chad Rogers, Senior Manager, Regulatory Affairs, AES Indiana
Brent Selvidge, Engineer, AES Indiana
Will Vance, Senior Analyst, AES Indiana

AES Indiana Legal Team
Nick Grimmer, Indiana Regulatory Counsel, AES Indiana
Teresa Morton Nyhart, Counsel, Barnes & Thornburg LLP

AES Indiana IRP Partners
Patrick Burns, PV Modeling Lead and Regulatory/IRP Support, Brightline Group
Eric Fox, Director, Forecasting Solutions, Itron
Jeffrey Huber, Overall Project Manager and MPS Lead, GDS Associates
Jordan Janflone, EV Modeling Forecasting, GDS Associates
Stewart Ramsey, Managing Executive, Vanry & Associates
Mike Russo, Forecast Consultant, Itron
Jacob Thomas, Market Research and End-Use Analysis Lead, GDS Associates
Melissa Young, Demand Response Lead, GDS Associates
Virtual Meeting Best Practices

**Questions**

- Your candid feedback and input is an integral part to the IRP process.
- Questions or feedback will be taken at the end of each section.
- Feel free to submit a question in the chat function at any time and we will ensure those questions are addressed.

**Audio**

- All lines are muted upon entry.
- For those using audio via Teams, you can unmute by selecting the microphone icon.
- If you are dialed in from a phone, press *6 to unmute.

**Video**

- Video is not required, however, if you have a camera on, please refrain from distractions.
→ All meetings will be available for attendance via Teams. Meetings in 2022 may also occur in-person.

→ A Technical Meeting will be held the week preceding each Public Stakeholder Meeting for stakeholders with nondisclosure agreements. Tech Meeting topics will focus on those anticipated at the next Public Stakeholder Meeting.

→ Meeting materials can be accessed at www.aesindiana.com/integrated-resource-plan.
AES Purpose & Values

Accelerating the future of energy, together.

Safety first

Highest standards

All together
Make your virtual environment safer

1. Secure Your Accounts
   - Use unique, complex passphrases and enable two-factor authentication wherever possible.

2. Think before you click
   - on a link, file, or attachment on your laptop and mobile.

3. Know Your Network
   - Protect your home network by changing default passwords; use a VPN when conducting sensitive transactions or on public WiFi.

4. Protect your Device
   - Patch your devices regularly and be mindful of connecting unauthorized hardware like USB drives.

5. Share Data Responsibly
   - Control your social media settings and be mindful when posting publicly.

6. Be Safe by Being Prepared
   - Know the cyberattack types and report anything suspicious.
Welcome & Overview of AES Indiana

Kristina Lund, President & CEO, AES US Utilities
A Once in a Lifetime Transformation in the Energy Sector
AES: a unique culture of **excellence**, **innovation** and **customer-centric** product development.

7x
Edison Award Winner
Company Overview

30,308
Gross MW in operation*

$9.78 billion
Total 2020 revenues

6,909 MW
Renewable generation under construction or with signed PPAs

$34.6 billion
Total assets owned & managed

4 Continents

14 Countries

4 Market-oriented strategic business units

6 Utility companies

2.5 million
Customers served

8,200 people
Our global workforce

Recognized for our commitment to sustainability
→ MISO Member
→ 528 square miles
→ Serves downtown Indianapolis and 8 counties in Indiana
→ Serves > 500,000 regulated customers
→ 3,643 MW of Generation
  • 1,464 MW Coal*
  • 38 MW Oil
  • 1,745 MW Gas
  • 300 MW Wind
  • 96 MW Solar
→ Retiring Pete 1 & 2 – 630 MW of coal – and replacing with solar and storage in 2023/2024

*Includes Pete 1 retirement of 220 MW
Leading the inclusive, clean energy transition

- **Customer**: Reliability. Affordability. Diverse needs. Create value in how we serve customers today to become their energy partner in the future.
- **Smart Grid**: Use new technologies across our value chain to create the resilient grid of the future.
- **Sustainability**: Maintain reliability and affordability while driving lower carbon emissions.
- **Workforce of the Future**: Work differently, using new technologies and skills. Strengthen our culture of safety, innovation and belonging.

Facilitate economic and community development
IRP & Planning Model Overview

Erik Miller, Manager, Resource Planning, AES Indiana
Will Vance, Senior Analyst, AES Indiana
What is an Integrated Resource Plan?

Integrated Resource Plan (IRP) in Indiana —> 170 IAC 4-7-2

→ 20-year look at how AES Indiana will serve load
→ Submitted every three years
→ Plan created with stakeholder input
→ Modeling and analysis culminates in a preferred resource portfolio and a short-term action plan

What is a preferred resource portfolio?

“Preferred resource portfolio’ means the utility's selected long term supply-side and demand-side resource mix that safely, reliably, efficiently, and cost-effectively meets the electric system demand, taking cost, risk, and uncertainty into consideration.” IAC 4-7-1-1-cc

Stakeholders are critical to the process

AES Indiana is committed to providing an engaging and collaborative IRP process for its stakeholders:

→ Five Public Advisory Meetings for stakeholders to engage throughout the process
→ Five Technical Meetings available to stakeholders with nondisclosure agreements (NDA) for deeper analytics discussion
→ Planning documents and modeling materials will be shared with stakeholders with NDAs upon request
→ After full consideration of stakeholder input, the Preferred Resource Portfolio will be announced in the fall of 2022

IRP rules link: http://iac.iga.in.gov/iac/iac_title?iact=170&iaca=&submit=+Go Article 4. 170 IAC 4-7-2
Updated 2022 IRP Timeline

IRP Kickoff

Public Advisory Meeting #1
January 24, 2022

Public Advisory Meeting #2
March/April 2022

Public Advisory Meeting #3
May/June 2022

Public Advisory Meeting #4
July/August 2022

Public Advisory Meeting #5
Sept./Oct. 2022

File IRP no later than Nov. 1, 2022

AUG  SEPT  OCT  NOV  DEC  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEPT  OCT  NOV

2022

Market Potential Study – Includes biweekly stakeholder meetings
Load Forecast
Distribution System Planning

Core IRP Modeling

Portfolio Evaluation & Risk

Report Narrative

Other Inputs & Assumptions

Issue Generation RFP - Date TBD in 2022

AES Indiana is available for additional touchpoints with stakeholders to discuss IRP-related topics.

= Stakeholder Technical Meeting for stakeholders with executed NDAs held the week before each public stakeholder meeting

= Preferred Resource Portfolio selected
Public Advisory Schedule

Public Advisory Meeting #1 - January 24, 2022
- 2022 IRP Schedule & Progress
- 2019 IRP Recap
- Load, EV, DG Forecasts
- MPS Overview

Public Advisory Meeting #2 - March/April
- DSM Modeling & Inputs
- Replacement Resource Inputs
- Commodity Inputs

Public Advisory Meeting #3 - May/June
- Portfolio Matrix Framework
- Portfolio Metrics & Scorecard Framework
- Reliability Analysis

Public Advisory Meeting #4 - July/August
- Preliminary Modeling
- Risk Analysis
- Portfolio Metrics & Scorecard Review

Public Advisory Meeting #5 - September/October
- 2022 Modeling Insights
- Preferred Resource Portfolio & Short-Term Action Plan

Topics for meetings 2-5 are subject to change depending on modeling progress.
IRP Process Overview

Core IRP Modeling & Evaluation

- **DSM Market Potential Study (MPS)**
  - End Use Analysis
  - Comprehensive measure list
  - Measure uptake & potentials: MAP & RAP
  - Develop IRP model inputs (bundles)

- **Replacement Resource Costs**
  - Cost assumptions from 2020 RFP and Consultants, e.g. Wood Mackenzie, NREL
  - New RFP issued date TBD in 2022

- **Distribution System Planning (DSP)**
  - Bottom-up forecast on sample of constrained circuits
  - Assess EV and DG impacts
  - Load shapes inform IRP analysis

- **Load Forecast**
  - Itron SAE Methodology
  - Base, High & Low Scenarios
  - IRP model peak and energy inputs

- **Capacity Expansion Modeling**
  - Retirement and replacement analysis
  - Portfolio optimization

- **Production Cost Modeling & PVRR**
  - Prod Cost - Portfolio dispatch analysis serve as PVRR inputs
  - Portfolio PVRR analysis
  - Stochastic risk analysis

- **Portfolio Evaluation & Short-Term Action Plan**
  - Screen against Evaluation Criteria
  - Selection of Preferred Resource Portfolio & Short-Term Action Plan

- **IRP Submitted Nov. 1, 2022**

- **IRP-driven Filings**
  - DSM Filing
  - Certificate of Public Convenience and Necessity (CPCN) Filing

**Contributors:**
- DSM MPS – GDS Associates
- RFP – Sargent and Lundy
- DSP – Internal & Conrad Technical Services
- Load Forecast – Itron
- PVRR Calculations – Concentric
- IRP Modeling & Evaluation – Internal with ACES & Anchor Power support
Portfolio Metrics & Scorecard

Scorecard Framework in the 2019 IRP

→ Portfolio Metrics in the 2019 IRP included three key overarching categories: Cost, Environmental and Risk

→ In 2022, AES Indiana will consider additions to the scorecard, such as reliability metrics
Planning Model Overview

EnCompass

→ Long-term Production Cost and Capacity Expansion model created by Anchor Power Solutions.

→ EnCompass is used by utilities, co-ops, municipalities, and consultants. It has been used to support regulatory filings in 17 states.
EnCompass

EnCompass models thermal, renewable, storage, and load resources with hourly granularity.

It will be used for capacity expansion analysis to make long-term resource decisions based on scenario input assumptions.

Based on resource selections, EnCompass will calculate the present value revenue requirement of each portfolio.

Through the use of stochastic analysis, EnCompass will be used to understand the risk associated with portfolios.
**EnCompass**

**Key Advantages of Utilizing EnCompass**

- Quick run times
  - Allows for additional scenario analysis
  - Provides expedient model feedback

- Straightforward capacity expansion
  - Deterministic capacity expansion allows for more intuitive cause and effect results

- User control of modeling parameters
  - MIP Stop Basis is a user input for capacity expansion
  - Stochastic draws can be specified by user

- Model Transparency
  - Transparent hourly renewable and load profiles
2019 IRP Recap

Aaron Cooper, Chief Commercial Officer, AES US Utilities
Erik Miller, Manager, Resource Planning, AES Indiana
2019 IRP – Short-Term Action Plan

<table>
<thead>
<tr>
<th>Retire</th>
<th>Replace</th>
<th>Save</th>
<th>Monitor</th>
</tr>
</thead>
</table>
| Retire 630 MW of coal generation by 2023:  
→ Pete 1: 2021  
→ Pete 2: 2023 | Competitively bid for approximately 200 MW of firm capacity with all-source RFP. | Target – 130,000 MWh per year of new DSM as part of the 2021-2023 DSM Plan. | Maintain cost-effective units at Petersburg to retain flexibility and continue to monitor market conditions leading to our 2022 IRP. |

Short-Term Action Plan Progress

→ **December 2019 - July 2021** – AES Indiana issues & evaluates all-source RFP for approximately 200 MW of firm capacity in 2023 that will result from the anticipated retirements of Pete Units 1 & 2.

→ **November 2020** – AES Indiana receives IURC Order for the implementation of DSM programs in 2021-2023. DSM portfolio will target approximately 130,000 MWh per year.

→ **May 2021** – AES Indiana retires Petersburg Unit 1 (220 MW).

→ **June 2021** – AES Indiana receives IURC Order approving the CPCN for Hardy Hills Solar (195 MW) identified through the RFP process. Project estimated COD May 2023.

→ **November 2021** – AES Indiana receives IURC Order approving the CPCN for the Petersburg Energy Center Solar + Storage project (250 MW solar; 45 MW 4-hr battery) identified through the RFP process. Project estimated COD June 2024.

→ **May 31, 2023** – Plans for retirement of Petersburg Unit 2 (410 MW).
Portfolio changes have reduced carbon intensity by 48% since 2015

Petersburg Unit 1 retired May 31, 2021
Petersburg Unit 2 anticipated retirement May 31, 2023
Hardy Hills Solar

Project Information

- **Type**: Solar facility
- **Size**: 195 MWac ICAP
- **COD**: 2023
- **Location**: Clinton County, IN
- **Developer**: Invenergy Solar Development North America, LLC

Hardy Hills will contribute 98 MW to AES Indiana’s 2023 UCAP need resulting from the retirement of Petersburg Units 1 & 2.
Petersburg Energy Center

Project Information

- **Type:** Solar and battery energy storage facility
- **Size:** 250 MWac ICAP coupled with a 180 MWh DC battery energy storage system (45 MW, 4-hour discharge power capacity)
- **COD:** 2024
- **Location:** Pike County, IN
- **Developer:** NextEra Energy Resources, LLC

Petersburg Energy Center will contribute 168 MW to AES Indiana’s 2023 UCAP need resulting from the retirement of Petersburg Units 1 & 2.
## IURC Director’s Comments to 2019 IRP

<table>
<thead>
<tr>
<th>Topic</th>
<th>Comments Summary <em>(not exhaustive)</em></th>
<th>2022 IRP Improvements</th>
</tr>
</thead>
</table>
| Resource Optimization & Risk | General **lack of clarity** around the model and methodology  
→ PowerSimm’s **stochastic capacity expansion methodology caused confusion** and lacked explanation  
→ “Future IRPs would **benefit from industry experts’ judgments** to evaluate whether there is a rationale for hardwiring certain resource.” – p.26, *Director’s Report for Indianapolis Power and Light’s 2019 IRP* |  
→ **AES IN will provide better explanation of the model and methodology used at stakeholder meetings and in the report.**  
→ **AES IN is transitioning to deterministic capacity expansion using Encompass** which should provide a more straightforward methodology.  
→ An outside third-party consultant will provide **industry expert guidance** regarding resource options and modeling approaches. |
| DSM Modeling | DSM bundles span the entire planning period which is too long  
→ Combining unrelated measures across residential and C&I measures makes a **questionable load shape**  
→ Important that **hourly impact of DSM measures** be given particular attention |  
→ **Encompass will allow for optimization using shorter duration bundles; AES IN will collaborate with stakeholders to determine more appropriate bundle durations.**  
→ **AES IN will collaborate with our consultants and stakeholders to consider alternative approaches** for measure bundling  
→ **AES IN will work with LBNL and NREL to capture the hourly shapes associated with DSM measures for inclusion in the portfolio modeling** |
| Load Forecasting | **IRP excluded detailed Itron report** in the appendix  
→ IRP excluded analysis on the **appropriateness of base temperature** for weather normalization  
→ IRP excluded discussion of **street lighting usage** and how it is modeled in the load forecast  
→ IRP excluded discussion of risk and uncertainty associated with the **load forecasting scenarios** |  
→ **AES IN has contracted Itron to perform the load forecast and provide a detailed report** that describes the methodology including all items noted to by the Director |
Overview of Existing Resources

Aaron Cooper, Chief Commercial Officer, AES US Utilities
Erik Miller, Manager, Resource Planning, AES Indiana
Starting Point Portfolio

AES Indiana summer UCAP MW forecast

- Petersburg Energy Center Online
- Hardy Hills Online
- HS ST5-6 Age-Based Retirement
- HS ST7 Age-Based Retirement
- Pete 3-4 Age-Based Retirement

Net Position

2022 IRP
AES Indiana: Current Generation Mix

TECHNOLOGY – ICAP MW / UCAP MW

ICAP

- Solar: 14.7%
- Storage: 1.2%
- Wind: 8.1%
- Oil: 0.0%
- Gas: 47.4%

- Coal: 28.6%

UCAP

- Solar: 9.4%
- Storage: 1.5%
- Wind: 0.2%
- Oil: 0.0%

- Coal: 34.2%

*Assumes Pete 2 and HS Diesel retirements, as well as the Hardy Hills and Petersburg Energy Center additions.
## Existing Coal Resources

<table>
<thead>
<tr>
<th>Coal Units</th>
<th>Reference Name</th>
<th>Technology</th>
<th>ICAP (MW)</th>
<th>UCAP (MW)</th>
<th>In-Service Year</th>
<th>Estimated Last Year In-Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petersburg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PETE ST 2</td>
<td>Pete 2</td>
<td>Coal ST</td>
<td>410</td>
<td>368</td>
<td>1969</td>
<td>2023</td>
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<tr>
<td>PETE ST 3</td>
<td>Pete 3</td>
<td>Coal ST</td>
<td>518</td>
<td>488</td>
<td>1977</td>
<td>2042</td>
</tr>
<tr>
<td>PETE ST 4</td>
<td>Pete 4</td>
<td>Coal ST</td>
<td>536</td>
<td>520</td>
<td>1986</td>
<td>2042</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Total Coal:</strong></td>
<td><strong>1,464</strong></td>
<td><strong>1,376</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Notes on units:

- Petersburg Unit 1 retired on May 31, 2021 consistent with the 2019 IRP Short Term Action Plan
- Petersburg Unit 2 scheduled to retire on May 31, 2023 is consistent with the 2019 IRP Short Term Action Plan
## Existing Gas Resources

<table>
<thead>
<tr>
<th>Gas Units</th>
<th>Reference Name</th>
<th>Technology</th>
<th>ICAP (MW)</th>
<th>UCAP (MW)</th>
<th>In-Service Year</th>
<th>Estimated Last Year In-Service</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Eagle Valley</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>EV CCGT</td>
<td>Eagle Valley</td>
<td>CCGT</td>
<td>671</td>
<td>601</td>
<td>2018</td>
<td>2055</td>
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<tr>
<td><strong>Harding Street</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HS 5G</td>
<td>Harding Street 5</td>
<td>Gas ST</td>
<td>100</td>
<td>93</td>
<td>1958</td>
<td>2030</td>
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<tr>
<td>HS 7G</td>
<td>Harding Street 7</td>
<td>Gas ST</td>
<td>415</td>
<td>399</td>
<td>1973</td>
<td>2033</td>
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<tr>
<td>HS GT4</td>
<td>Harding Street GT4</td>
<td>Gas CT</td>
<td>74</td>
<td>67</td>
<td>1994</td>
<td>2044</td>
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<tr>
<td>HS GT5</td>
<td>Harding Street GT5</td>
<td>Gas CT</td>
<td>74</td>
<td>69</td>
<td>1995</td>
<td>2045</td>
</tr>
<tr>
<td>HS GT6</td>
<td>Harding Street GT6</td>
<td>Gas CT</td>
<td>154</td>
<td>140</td>
<td>2002</td>
<td>2052</td>
</tr>
<tr>
<td>HS GT1 &amp; GT2</td>
<td>Harding Street GT1 &amp; 2</td>
<td>Oil</td>
<td>38</td>
<td>36</td>
<td>1973</td>
<td>2023/2024</td>
</tr>
<tr>
<td><strong>Georgetown</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GTOWN GT1</td>
<td>Georgetown 1</td>
<td>Gas CT</td>
<td>79</td>
<td>72</td>
<td>2000</td>
<td>2050</td>
</tr>
<tr>
<td>GTOWN GT4</td>
<td>Georgetown 4</td>
<td>Gas CT</td>
<td>79</td>
<td>75</td>
<td>2001</td>
<td>2052</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>1,745</td>
<td>1,610</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Oil</strong></td>
<td></td>
<td></td>
<td>38</td>
<td>36</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ICAP (MW)</strong></td>
<td><strong>UCAP (MW)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CCGT</td>
<td>671</td>
<td>601</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CT</td>
<td>460</td>
<td>423</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ST</td>
<td>614</td>
<td>586</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
## Existing Renewable Resources

<table>
<thead>
<tr>
<th>Renewable</th>
<th>Technology</th>
<th>ICAP (MW)</th>
<th>UCAP (MW)</th>
<th>In-Service Year/PPA Start</th>
<th>Estimated Last Year In-Service/PPA End</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hardy Hills</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hardy Hills</td>
<td>Solar Only</td>
<td>195</td>
<td>98</td>
<td>2023</td>
<td>TBD</td>
</tr>
<tr>
<td><strong>Petersburg Energy Center</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEC Solar</td>
<td>Solar + BESS</td>
<td>250</td>
<td>125</td>
<td>2024</td>
<td>TBD</td>
</tr>
<tr>
<td>PEC BESS</td>
<td>Solar + BESS</td>
<td>180 MWh</td>
<td>45 MW, 4-hour</td>
<td>2024</td>
<td>TBD</td>
</tr>
<tr>
<td><strong>PPAs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hoosier Wind Park (IN)</td>
<td>PPA</td>
<td>100</td>
<td>7</td>
<td>2009</td>
<td>2029</td>
</tr>
<tr>
<td>Lakefield Wind (MN)</td>
<td>PPA</td>
<td>200</td>
<td>0</td>
<td>2011</td>
<td>2031</td>
</tr>
<tr>
<td>Solar (Rate REP)</td>
<td>PPA</td>
<td>96</td>
<td>54</td>
<td>varies</td>
<td>varies</td>
</tr>
<tr>
<td><strong>Total Renewable:</strong></td>
<td></td>
<td>841</td>
<td>328</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Lakefield Wind has no firm transmission and therefore receives no capacity credit from MISO to AES.
- Rate REP solar receives no capacity credit from MISO; rather it serves as a reduction to load in the PRA.
- UCAP values are based on current MISO capacity credit levels for renewable resources. These values will likely fall over time as renewable penetration increases within MISO.

<table>
<thead>
<tr>
<th></th>
<th>ICAP (MW)</th>
<th>UCAP (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar</td>
<td>541</td>
<td>277</td>
</tr>
<tr>
<td>Wind</td>
<td>300</td>
<td>7</td>
</tr>
<tr>
<td>Storage</td>
<td>45</td>
<td>43</td>
</tr>
</tbody>
</table>
Existing DSM Resources

DEMAND RESPONSE

<table>
<thead>
<tr>
<th>Load Modifying Resources</th>
<th>Summer Capacity Value (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Conditioner Load Management</td>
<td>46.3</td>
</tr>
<tr>
<td>Conservation Voltage Reduction</td>
<td>16.8</td>
</tr>
<tr>
<td>Rider 14</td>
<td>1.1</td>
</tr>
</tbody>
</table>

ENERGY EFFICIENCY

→ Avg annual incremental program savings of 1% per year of 2021 sales
→ Savings of approximately 10% of 2021 sales from measures installed to date
Replacement
Resource Options

Erik Miller, Manager, Resource Planning, AES Indiana
# Commercially Available Replacement Resources

<table>
<thead>
<tr>
<th>DSM/EE</th>
<th>Wind</th>
<th>Solar</th>
<th>Storage</th>
<th>Natural Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>→ EE &amp; DR Measures bundled into traunches for planning model selection</td>
<td>→ Land-Based Wind</td>
<td>→ Utility-Scale</td>
<td>→ Standalone Front-of-meter</td>
<td>→ CCGT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>→ C&amp;I</td>
<td>→ Solar + Storage</td>
<td>→ CT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>→ Residential</td>
<td>→ Wind + Storage</td>
<td>→ Reciprocating Engine/ICE</td>
</tr>
</tbody>
</table>
The energy sector is transforming, and many new generation technologies are under development that can be utilized to support AES Indiana’s commitment to achieve our customers’ goals of reliability, affordability and sustainability.

These technologies include but may not be limited to:

→ Green Hydrogen
→ Small Modular Reactors (SMRs)
→ Gravity Energy Storage
→ Pumped-hydro Storage
→ Carbon Capture and Sequestration (CCS)

As a company, we see these technologies as providing optionality in a path towards reducing carbon and we plan to consider them in future IRPs as they become commercially available.

AES Indiana welcomes stakeholder input regarding new & emerging technologies.
2022 Integrated Resource Plan (IRP)

Baseline Energy & Load Forecast

Presented by Itron
Introduction to the Itron Team

→ Itron has over 30 years of experience developing forecast models for customers worldwide. Itron’s energy forecasting group is nationally recognized for its expertise in short-term forecasting (hour-ahead and day-ahead), financial forecasting (1-3 years-ahead), and long-term forecasting (10-20 years-ahead).

We are a leading provider of forecasting solutions to independent system operators (ISO), regional transmission organizations, energy retailers, public utilities, municipalities, and cooperatives.

→ Itron specializes in long-term load modeling, regulatory support, statistical analysis, and forecasting system implementation. The forecasting staff includes economists, statisticians, programmers, and consultants that have extensive experience in these areas, as well as database design and software development.
Agenda

→ Sales, Energy, and Demand Trends

→ Modeling Approach

→ Baseline Forecast
Sales, Energy and Demand Trends
AES Indiana serves over 500,000 customers across residential, commercial, and industrial customer class. The residential class accounts for nearly 90% of the customers and 40% of system sales. Commercial sales 40%. Industrial sales 20%. 

2019 Sales Mix (GWh)

- Residential: 5,219 GWh (39%)
- Commercial: 5,279 GWh (39%)
- Industrial: 2,889 GWh (22%)

2019 Customer Mix

- Residential: 445,760 (88.45%)
- Commercial: 58,033 (11.51%)
- Industrial: 191 (0.04%)
Despite relatively strong customer growth, system energy and peak demand has been declining as efficiency gains have outweighed customer growth.
The number of customers has increased from 417,000 in 2010 to 455,500 by year-end 2021. Adding approximately 3,500 new customers per year.

But despite strong customer growth, sales have been flat with average use declining at roughly the same rate as customer growth.
What’s Driving Customer Growth

**Strong population and household growth**

→ Home to over 876,000 people and more than 2 million residents in the metropolitan area. Third most populous city in the Midwest behind Chicago and Columbus. Population projected to grow 26% over the next 30 years

**Strong regional economy**

→ Regional GDP over $126 billion (Fed Reserve Bank of St. Louis)
→ Employment growth 1.7% year over year, over 1 million employed in the metro area

**Affordable Housing**

→ According to Kiplinger’s, Indianapolis has an affordability index of 1 out of 10, (based on percent of income needed to buy a median price home, $185,000)

The Indianapolis real estate market: stats & trends for 2021 (roofstock.com)
https://www.kiplinger.com/article/real-estate/t010-c000-s002-home-price-changes-in-the-100-largest-metro-areas.html
Strong efficiency improvements in the commercial sector

AES Energy Efficiency Program Activity

LED Adoption

Sharp drop in 2020 sales due to COVID-19
Industrial customers and sales have been trending down since 2010, but appears to be leveling off.

→ Manufacturing transitioning to less energy intensive industry mix and end-use processes, and strong efficiency gains.
Who are AES’s largest customers

- What is classified as industrial, includes significant commercial activity
- Health care
- Education
- Office - Management/Administrative
- Distribution
- The distinction between commercial and industrial activity is blurring
- AES’s 10 largest customers account for approximately 14% of sales
Street Lighting: LED Conversion Program

Operation Night Light is a public-private sector partnership that began in 2016 between the City of Indianapolis and AES Indiana. By converting to high-efficiency LED technology, the city would see savings generated due to lower maintenance costs and energy usage.

- 27,000 streetlights across Marion County have been converted to high-efficiency LED fixtures
- Since the LED program began, electricity usage is down over 67%
- New lights will continue to be installed through 2025
Why is Average Use Declining?

- Residential. End-use intensities have been declining across nearly all end-uses except miscellaneous. Over the last 10 years:
  - Heating down 0.5%
  - Cooling down 0.4%
  - Base down 0.2%

- Similar trends in the commercial sector with the strongest decline in lighting and computer related loads. Over the last 10 years:
  - Heating down 1.9% (minimal commercial heating)
  - Cooling down 0.2%
  - Base down 1.2%
Energy Efficiency Programs have had a significant impact on sales
- Reduce residential average use by 8% over the last ten years
- And reduce commercial sales by 13%

### Annual Cumulative Saving (MWh)

<table>
<thead>
<tr>
<th>Year</th>
<th>Res</th>
<th>Com</th>
<th>Ind</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>30,123</td>
<td>21,547</td>
<td>3,456</td>
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<tr>
<td>2012</td>
<td>66,290</td>
<td>49,406</td>
<td>7,923</td>
</tr>
<tr>
<td>2013</td>
<td>133,328</td>
<td>103,074</td>
<td>16,530</td>
</tr>
<tr>
<td>2014</td>
<td>170,356</td>
<td>166,836</td>
<td>26,756</td>
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<tr>
<td>2015</td>
<td>201,208</td>
<td>206,761</td>
<td>33,158</td>
</tr>
<tr>
<td>2016</td>
<td>247,829</td>
<td>299,311</td>
<td>48,001</td>
</tr>
<tr>
<td>2017</td>
<td>274,827</td>
<td>365,279</td>
<td>58,580</td>
</tr>
<tr>
<td>2018</td>
<td>315,502</td>
<td>444,192</td>
<td>71,235</td>
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<tr>
<td>2019</td>
<td>372,124</td>
<td>522,340</td>
<td>83,768</td>
</tr>
<tr>
<td>2020</td>
<td>396,524</td>
<td>589,484</td>
<td>94,536</td>
</tr>
</tbody>
</table>
Modeling Approach
Baseline Modeling Approach

→ Bottom-up Modeling Approach

→ Estimate rate-class level sales and customer models from historical billed sales data

→ Sales/energy driven by households, economic forecasts, expected weather conditions, price, and end-use efficiency improvements. End-use demand drives system peak demand

Monthly sales and customer models are estimated for:
- Residential
- Commercial
- Industrial
- Other (Lighting)

Monthly peak model driven by end-use energy forecasts

THE BASELINE FORECAST EXCLUDES BEHIND THE METER SOLAR, ELECTRIC VEHICLE LOADS, AND FUTURE EE PROGRAM SAVINGS
→ Moody Analytics (August 2021), economic forecast for Marion County.

→ Population projections drive the residential customer forecast. Expected population growth slightly slower than the last ten years.

→ Household income influences customer use.
→ Real income growth slightly lower than prior ten-years.

<table>
<thead>
<tr>
<th>Period</th>
<th>Avg Annual Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010-19</td>
<td>0.7%</td>
</tr>
<tr>
<td>2022-40</td>
<td>0.6%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Period</th>
<th>Avg Annual Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010-19</td>
<td>1.8%</td>
</tr>
<tr>
<td>2022-40</td>
<td>1.5%</td>
</tr>
</tbody>
</table>
C&I Economic Drivers

→ Non-manufacturing output tracks U.S. growth
→ Slower employment growth in the out years. Implies higher long-term productivity.
Residential End-Use Intensity Projections

- End-Use intensities based on end-use saturation and average stock efficiency derived from EIA's Annual Energy Outlook (AEO) for East North Central Census Division.

- Residential calibrated to AES service area based on historical appliance saturation surveys and DSM potential study.

<table>
<thead>
<tr>
<th>End-Use</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating</td>
<td>-0.6%</td>
</tr>
<tr>
<td>Cooling</td>
<td>-0.1%</td>
</tr>
<tr>
<td>Base</td>
<td>0.1%</td>
</tr>
</tbody>
</table>
Commercial End-Use Intensity Projections

- End-Use intensities (kWh per square ft) projected for 9 end-uses and 11 building types
- Derived from EIA’s Annual Energy Outlook (AEO) for East North Central Census Division.
- Building-type intensities weighted to the AES service area based on AES commercial sales.
- Projected efficiency gains in lighting and ventilation have the largest impact on base use.

![Commercial End-Use Intensity](chart.png)

### Avg. Annual Growth

<table>
<thead>
<tr>
<th>End-Use</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating</td>
<td>-1.8%</td>
</tr>
<tr>
<td>Cooling</td>
<td>-0.1%</td>
</tr>
<tr>
<td>Base</td>
<td>-0.7%</td>
</tr>
</tbody>
</table>
Temperature Trends

→ Average annual temperature is increasing .05 degrees per year or 0.5 degrees per decade.

→ Consistent with temperature trends across the country 0.4 degrees to 1.0 degrees per decade.

→ Minimum temperature increasing twice as fast as the average temperature. No increase in the maximum temperature.
Increasing average temperature translates into 0.3% annual growth in cooling degree days.

And 0.4% annual decline in heating degree days.
Impact of Increasing Temperatures

Increasing temperatures contribute to cooling load growth in turn driving system peak demand.

0.05% annual temperature change contributes to 0.1% annual increase in baseline peak demand adding 82 MW by 2042.

→ Little change in energy requirements as increase in cooling loads is offset by decrease in heating loads.
Peak demand is driven by heating, cooling, and base load requirements derived from the rate class sales forecast models.

**Cooling Load Requirements**
- Residential
- Commercial
- Industrial

**Heating Load Requirements**
- Residential
- Commercial
- Industrial (if applicable)

**Base Load Requirements**
- Residential
- Commercial
- Industrial
- Lighting

Peaks are calculated based on:
- Peak day CDD
- Peak day HDD
- Peak day heating demand
- Peak day base Load demand
Peak Model Drivers

→ Heating, cooling, and base-use energy requirements derived from sales forecast models.

→ Base-use energy allocated to end-use coincident peak loads. Highest load in winter – lighting load.
Baseline Forecast
Baseline Class Sales Forecast

- Excludes
  - Future Energy Efficiency Program savings
  - Electric vehicle charging loads
  - Future Behind-the-Meter solar adoption
Energy & Peak Forecast

- Baseline Forecast excludes energy efficiency programs (EE), electric vehicles, and solar impact
- IRP Forecast includes the impact of electric vehicles and solar but excludes EE
- Green line shows energy and peak demand with future EE continuing at current levels
- With EE, energy and peak trend is consistent with the last ten-years
2022 Integrated Resource Plan (IRP)

Electric Vehicle (EV) and Solar PV Forecasts

Presented by IRP Partners

GDS Associates, Inc. Engineers & Consultants
brightline Group
aes Indiana
Introduction to the GDS team

GDS will serve as the prime contractor for these studies. GDS is a privately-held multi-service engineering and consulting firm, with more than 175 employees. Our broad range of expertise focuses on clients associated with, or affected by electric, natural gas, water and wastewater utilities. GDS has completed over 75 energy efficiency and demand response potential studies over the last two decades. GDS also has significant experience in: Statistical & Market Research Services, Integrated Resource Planning, Load Forecasting Services, and Regulatory Support Services.

Woman-owned collective of industry experts in DSM program planning and evaluation, with over 60 years of combined experience in the energy efficiency and engineering industry. Members of the Brightline Group has previously worked for GDS on I&M, Ameren Missouri, California POU, and Pennsylvania PUC evaluation and market research projects.
DSM Market Potential Study Introduction

Electric Vehicle (EV) / Solar PV Forecasts

Patrick Burns, PV Modeling Lead and Regulatory/IRP Support, Brightline Group
Jordan Janflone, EV Modeling Forecasting, GDS Associates
Residential Electric Vehicle Forecast

→ Goal is to forecast total number of EVs and resulting energy use in AES-IN service territory
→ Various assumptions are needed as inputs
→ Very broad ranges for EV penetration in the market, various sources have differing opinions and projections
Residential Electric Vehicle Forecast

→ EV Unit forecast informs EV Total Energy Forecast
→ Similar process to a typical customer class forecast

Total number of EVs

Total energy consumed by EVs
## Residential Electric Vehicle Forecast

<table>
<thead>
<tr>
<th>Input</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of residential customers</td>
<td>AES-IN Load Forecast</td>
</tr>
<tr>
<td>Average number of vehicles per household</td>
<td>U.S. Census – Indianapolis Metropolitan Area</td>
</tr>
<tr>
<td>Average vehicle life</td>
<td>U.S. Department of Transportation</td>
</tr>
<tr>
<td>Initial number of EVs</td>
<td>EV Registration data from AES-IN</td>
</tr>
<tr>
<td>Passenger car to light truck ratio</td>
<td>Energy Information Administration (EIA)</td>
</tr>
<tr>
<td>EV sales as percentage of total vehicle sales</td>
<td>Multiple scenarios and studies considered</td>
</tr>
<tr>
<td>Average kWh per mile</td>
<td>U.S. Department of Energy</td>
</tr>
<tr>
<td>Average miles per year driven by EV</td>
<td>Car &amp; Driver EV Owner Study</td>
</tr>
</tbody>
</table>
Residential Customer Forecast

AES Forecast - # of Residential Customers

2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
400,000 420,000 440,000 460,000 480,000 500,000 520,000 540,000
EV Sales Trend Forecast

Assumed EV % of New Vehicle Sales

- Linear Trend
- Exponential
- Bass Diffusion
EV Sales Scenarios

→ Linear trend was selected for scenario modeling
→ EIA uses a linear trend sales trend
→ 3 trend scenarios were modeled
→ Low projections are similar to current EIA forecast
→ Medium aligns with a blend of the BCG and EPRI medium projections
→ High projections are similar to EPRI High.
EV Sales Scenarios

Number of Electric Vehicles in AES Territory

- Low
- Base
- High
Electric Vehicle Energy (MWh) Forecast

- Energy is a function of total EV units, average kWh/mile, and total number of miles/year/EV

- 3 trend scenarios were modeled
  - Low, Base, High

<table>
<thead>
<tr>
<th>Input</th>
<th>Base</th>
<th>High</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Vehicles in 2021</td>
<td>3,575</td>
<td>3,575</td>
<td>3,575</td>
</tr>
<tr>
<td>% of EV Sales in 2030</td>
<td>11%</td>
<td>21%</td>
<td>6%</td>
</tr>
<tr>
<td>% of EV Sales in 2040</td>
<td>20%</td>
<td>40%</td>
<td>10%</td>
</tr>
<tr>
<td>Miles/year/vehicle</td>
<td>5,300</td>
<td>8,000</td>
<td>4,000</td>
</tr>
<tr>
<td>Average kWh/mile</td>
<td>0.345</td>
<td>0.345</td>
<td>0.345</td>
</tr>
</tbody>
</table>
EV Energy (MWh) Forecast

Electric Vehicle MWh Sales

- Low
- Base
- High

Years: 2021 to 2040
Residential Electric Vehicle Load Shape

→ Load shapes for electric vehicles come from:
  → Non-managed Charging – Guidehouse which uses a blend of utility EV metering programs and synthetic datasets from US National Labs
  → Managed Charging – AES Indiana AMI data from EVX customers

Weekday: Non-managed Customer Profile

Weekday: Managed Customer Profile
PV Preliminary Forecast

Forecast Framework – Bass diffusion model

→ Key parameters:
  → Existing market share
  → Maximum market share
  → Coefficients of innovation (p) and imitation (q)
PV Preliminary Forecast – Bass model parameters

→ Existing market share:
  → AES IN 2021 Q3 cumulative net metering data
    • 625 existing residential systems
    • 46 existing non-residential systems

→ Maximum market share:
  → AES IN customer forecast
  → PV technical constraint factor
    • 48% residential; 79% non-residential
    • Based on NREL NSRDB data which accounts for constraints such as shading, contiguous roof area, panel orientation, etc.

→ Coefficients of innovation (p) and imitation (q):
  → NREL dGen model (based on state-level EIA DGPV interconnection and Census data)
PV Preliminary Forecast – Scenario Analysis

3 Business-As-Usual (BAU) Scenarios Considered

→ Scenarios based on adoption probability:
  → Currently estimated based on CAGR of historically installed systems within AES IN territory and regional customer WTP survey data
  → Will be updated based on findings from AES IN market research

→ Residential:
  → High: 29% market adoption
  → Medium: 15% market adoption
  → Low: 6% market adoption

→ Non-Residential:
  → High: 35% market adoption
  → Medium: 19% market adoption
  → Low: 7% market adoption
PV Preliminary Forecast

Model forecast results – Residential

Solar Adoption - No. of Systems

- BAU - high
- BAU - medium
- BAU - low
Model forecast results – Residential

Solar Generation – MWh DC

- Low
- Base
- High

2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050

MWh - DC

0 100,000 200,000 300,000 400,000 500,000 600,000 700,000 800,000
PV Preliminary Forecast

Model forecast results – Non-Residential

Solar Adoption - No. of Systems

Number of Premises

Year

2020 2025 2030 2035 2040 2045 2050

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

BAU - high — BAU - medium — BAU - low
PV Preliminary Forecast

Model forecast results – Non-Residential

Solar Generation – MWh DC

- Low
- Base
- High

MWh - DC

2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
Load shapes for solar come from:

- Residential customer AMI data for ground (50%) and roof (50%) solar installations
Introduction to the DSM Process in the IRP

IURC Rules – 170 IAC 4-7-8-c-4
"Analysis showing Supply-side resources and demand-side resources have been evaluated on a consistent and comparable basis."
Agenda

→ Overview
  • Team Introduction
  • Purpose of a Market Potential Study (MPS)
  • MPS/IRP Related Work

→ Market Research
  • End-Use Analysis
  • Willingness to Participate in DSM Programs

→ Energy Efficiency (EE) Potential
→ Demand Response (DR) Potential
→ Initial EV/PV Forecasts
Introduction to the GDS team

GDS will serve as the prime contractor for these studies. GDS is a privately-held multi-service engineering and consulting firm, with more than 175 employees. Our broad range of expertise focuses on clients associated with, or affected by electric, natural gas, water and wastewater utilities. GDS has completed over 75 energy efficiency and demand response potential studies over the last two decades. GDS also has significant experience in: Statistical & Market Research Services, Integrated Resource Planning, Load Forecasting Services, and Regulatory Support Services.

Woman-owned collective of industry experts in DSM program planning and evaluation, with over 60 years of combined experience in the energy efficiency and engineering industry. Members of the Brightline Group has previously worked for GDS on I&M, Ameren Missouri, California POU, and Pennsylvania PUC evaluation and market research projects.
What is a Market Potential Study?

Simply put, a potential study is a quantitative analysis of the amount of energy savings that either exists, is cost-effective, or could be realized through the implementation of energy efficiency programs and policies.
Purpose of a Market Potential Study

Market Potential Study identifies the remaining amount of EE/DR potential in the AES-IN service territory.

The savings potential from this analysis will be used to create EE/DR resources to be modeled in the IRP.

EE/DR selections from the IRP will be used to inform AES-IN DSM plan for 2024-2026.
DSM Market Potential Study Introduction

Market Research

Jeffrey Huber, Overall Project Manager and MPS Lead, GDS Associates
Jacob Thomas, Market Research and End-Use Analysis Lead, GDS Associates
Melissa Young, Demand Response Lead, GDS Associates
Market Research Activities

RESEARCH TO IMPROVE UPON INPUTS TYPICALLY USED IN BOTH LOAD FORECAST & MPS

- Primary & Secondary Research
  - Surveys & onsite visits
  - Building energy simulation models
  - CBECS

- Residential
  - End Use Market Share
  - Unit Energy Consumption

- Small Commercial & Industrial
  - End-use intensity
  - Distribution of customers by building type
  - End-use saturation

RESEARCH TO HELP UNDERSTAND MOTIVATIONS AND BARRIERS TO ADOPTION

- Willingness to Participate (WTP) at varying incentive levels
  - Residential / Commercial
  - Asked for EE / DR / DER

- Importance of financial/non-financial motivations and barriers toward adoption
  - Motivations: Energy/bill savings, personal sustainability goals, improved comfort, increased reliability, quieter operation, etc.
  - Barriers: Upfront cost, access to financing, uncertainty about savings, lack of knowledge, limitations of building characteristics, unwanted features or negative impacts on aesthetics/comfort, etc.

- Awareness of current AES-IN Programs
## Residential Baseline Survey Statistics

<table>
<thead>
<tr>
<th>Market Segment</th>
<th>Sample Design</th>
<th>Sample Frame</th>
<th># of Responses</th>
<th>Response Rate</th>
<th>Achieved Precision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Residential Population</td>
<td>95/5 Design = 384 Responses</td>
<td>15,000 (100%)</td>
<td>972</td>
<td>6.5%</td>
<td>3.1% @ 95% Conf.</td>
</tr>
<tr>
<td>Multifamily Homes</td>
<td>90/10 Design = 68 Responses</td>
<td>2,720 (18%)</td>
<td>231</td>
<td>8.5%</td>
<td>5.4% @ 90% Conf.</td>
</tr>
<tr>
<td>Single Family Homes</td>
<td>316 Responses</td>
<td>12,280 (82%)</td>
<td>741</td>
<td>6.0%</td>
<td>3.0% @ 90% Conf.</td>
</tr>
</tbody>
</table>

* Commercial survey underway. Roughly 9,000 accounts in sample frame.*
Equipment Characteristics

- Data collection elements limited to items that may be answered accurately
- Residential survey collected
  - Ownership, age, and count of electric end-use appliances
  - Information on smart appliances and electric vehicles
- Nonresidential survey focused on key electric end-uses
  - Ex: Lighting, Cooling, Heating, Ventilation, Water Heating, Refrigeration
- Key Equipment Penetration
- Limited Efficiency Saturation Characteristics

![Pie chart showing primary source of heat]

- Electric: 47%
- Gas: 53%
- Other: 1%

![Bar chart showing average number per home]

- Refrigerator
- Separate Freezer
- Electric Clothes Dryer
- Electric Clothes Washer
- Electric Water Heater
### Willingness to Participate (WTP) Sample Sizes

<table>
<thead>
<tr>
<th>Residential Modules</th>
<th>Est # of Completions</th>
<th>Actual # of Completions</th>
<th>Achieved Precision @ 90% Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Heater Efficiency</td>
<td>180</td>
<td>349</td>
<td>4.4%</td>
</tr>
<tr>
<td>Clothes Dryer Efficiency</td>
<td>146</td>
<td>264</td>
<td>5.1%</td>
</tr>
<tr>
<td>Insulation Efficiency</td>
<td>230</td>
<td>279</td>
<td>4.9%</td>
</tr>
<tr>
<td>HVAC Efficiency</td>
<td>195</td>
<td>283</td>
<td>4.9%</td>
</tr>
<tr>
<td>DER – Solar PV</td>
<td>180</td>
<td>269</td>
<td>5.0%</td>
</tr>
<tr>
<td>DER – Electric Vehicles</td>
<td>195</td>
<td>236</td>
<td>5.4%</td>
</tr>
<tr>
<td>Water Heater Control DR</td>
<td>146</td>
<td>229</td>
<td>5.4%</td>
</tr>
<tr>
<td>Smart Thermostat DR</td>
<td>158</td>
<td>157</td>
<td>6.6%</td>
</tr>
<tr>
<td>Time of Use Rate DR</td>
<td>72</td>
<td>88</td>
<td>8.8%</td>
</tr>
</tbody>
</table>

* Commercial WTP survey underway. Similarly targets several commercial EE end-uses (HVAC, Water Heating, Refrigeration, Lighting), DER (Solar Purchase/Leased) and DR (AC Control, Critical Peak Pricing) options.
WTP Survey Research

→ Represents the proportion of customers who can be reasonably expected to perform energy efficiency upgrades through DSM programs

→ Used to estimate likely long-term adoption rates for achievable potential scenarios

→ Long-term adoption rates will be estimated at the end-use or measures level for key end uses:

- HVAC
- Water Heating
- Lighting
- Refrigeration
- Appliances
- Building Shell
- Distributed Energy Resources
- Demand Response
DSM Market Potential Study Introduction

Energy Efficiency (EE) Potential

Jeffrey Huber, Overall Project Manager and MPS Lead, GDS Associates
Jacob Thomas, Market Research and End-Use Analysis Lead, GDS Associates
Melissa Young, Demand Response Lead, GDS Associates
Overall Market Potential Study Process

LOAD DISAGGREGATION
Sales by Market Segment
Consumption by End Use

DATA COLLECTION
New & Existing Primary Data, Secondary Data Collection

UTILITY SALES FORECAST BY SECTOR
Baseline End-Use Consumption by Sector & Market Segment

MEASURE DATA
Technical Potential

TECHNOLOGY CHARACTERISTICS
Energy, Capacity, and Therm Unit Savings
Saturation Shares
Codes and Standard Updates
Applicability Interactions

ECONOMIC POTENTIAL
COST-EFFECTIVENESS
Load Shapes
Avoided Cost Benefits
Measure Costs / Price Trends

MARKET ADOPTION
Historical Performance
Short term and Long Term Market Barriers

ACHIEVABLE POTENTIAL
## MPS Segmentation

<table>
<thead>
<tr>
<th>Residential</th>
<th>Commercial</th>
<th>Industrial</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Home Types</strong></td>
<td><strong>End-Uses</strong></td>
<td><strong>Building Types</strong></td>
</tr>
<tr>
<td>Single Family – Market Rate</td>
<td>Whole Building</td>
<td>Education</td>
</tr>
<tr>
<td>Multifamily – Market Rate</td>
<td>Heat</td>
<td>Food/Liquor</td>
</tr>
<tr>
<td>Single Family – Income Qualified</td>
<td>Cool</td>
<td>Health Care</td>
</tr>
<tr>
<td>Multifamily – Income Qualified</td>
<td>WH</td>
<td>Hotel</td>
</tr>
<tr>
<td></td>
<td>Int. Lighting</td>
<td>Miscellaneous</td>
</tr>
<tr>
<td></td>
<td>Ext. Lighting</td>
<td>Office</td>
</tr>
<tr>
<td></td>
<td>Refrigeration</td>
<td>Restaurant</td>
</tr>
<tr>
<td></td>
<td>Other Appliances</td>
<td>Retail Store</td>
</tr>
<tr>
<td></td>
<td>Electronics</td>
<td>Warehouse</td>
</tr>
<tr>
<td></td>
<td>Pools</td>
<td>Office Equip.</td>
</tr>
<tr>
<td></td>
<td>Misc.</td>
<td>Air Comp.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Motors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Proc.</td>
</tr>
</tbody>
</table>
Several hundred energy efficiency measures will be considered.

Draft list of measures to be considered were shared with AES-IN Staff and members of the AES-IN Oversight Board (OSB).

Key data source: AES-IN planning and evaluation databases and Illinois TRM.

Measure assumptions include:

- Savings
- Incremental/full costs
- Measure interaction
- Measure life
- Measure Applicability
Emerging technologies and practices are defined as those that are either: (1) not yet commercialized but are likely to be commercialized and cost-effective for a significant proportion of end-users (on a life-cycle cost basis) over the next few years; or (2) commercialized, but currently have penetrated no more than 2% of the appropriate market (ACEEE).

- Reviewed latest TRMs, DOE databases, and the Northwest Energy Efficiency Alliance Emerging Tech Advisory Committee.

- Require some documented estimate of savings and/or costs for inclusion.

- MPS does not include a placeholder for “future unknown technologies”
## Energy Efficiency Potential Types

<table>
<thead>
<tr>
<th>Types of Energy Efficiency Potential</th>
<th>TECHNICAL POTENTIAL</th>
<th>ECONOMIC POTENTIAL</th>
<th>ACHIEVABLE POTENTIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Technically Feasible</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not Technically Feasible Not Cost-Effective</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not Technically Feasible Not Cost-Effective Not Cost-Effective Market &amp; Adoption Barriers</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### TECHNICAL POTENTIAL
All technically feasible measures are incorporated to provide a theoretical maximum potential.

### ECONOMIC POTENTIAL
All measures are screened for cost-effectiveness using the UCT Test. Only cost-effective measures are included.

### ACHIEVABLE POTENTIAL
Cost-effective energy efficiency potential that can practically be attained in a real-world program delivery case, assuming that a certain level of market penetration can be attained.
Technical Potential Calculation

**RESIDENTIAL EQUATION**

\[
\text{TECHNICAL POTENTIAL OF EFFICIENT MEASURES} = \text{Total Number of Households} \times \text{Base Case Equipment End Use Intensity} \times \text{Saturation Share} \times \text{Applicability Factor} \times \text{Savings Factor}
\]

**NON-RESIDENTIAL EQUATION**

\[
\text{TECHNICAL POTENTIAL OF EFFICIENT MEASURES} = \text{Total End Use Sales By Industry Type} \times \text{Base Case Factor} \times \text{Remaining Factor} \times \text{Convertible Factor} \times \text{Savings Factor}
\]
Economic Potential

**ECONOMIC POTENTIAL**
Subset of the Technical Potential that is economically cost effective (based on screening with the Utility Cost Test)

Screen measures for cost-effectiveness over the 20-year forecast horizon
Achievable / Program Potential

Example Residential Long-Term Adoption Rates by End Use and Incentive Level

Adoption Curve based on varying incentive levels (building shell example)
DSM Market Potential Study Introduction

Demand Response (DR) Potential

Jeffrey Huber, Overall Project Manager and MPS Lead, GDS Associates
Jacob Thomas, Market Research and End-Use Analysis Lead, GDS Associates
Melissa Young, Demand Response Lead, GDS Associates
Demand Response Programs Considered

- DLC – Central ACs
- DLC – Room ACs
- DLC – Smart Appliances
- DLC – Water Heaters
- DLC – Electric Space Heat
- DLC – Lighting
- Battery Energy Storage
- Electric Vehicle Charging
- Curtailment Agreements
- Demand Bidding
- Capacity Bidding
- Time of Use Rates
- Behavior DR
Demand Response Methodology

→ Analysis will be conducted using GDS Demand Response Model (DR Model)

→ Utility-specific data on avoided costs, line losses, and discount rates will be incorporated

→ Participation rates will be developed to simulate the rate at which load reductions can be attained over time

→ Current data on the estimated coincident peak (CP) load reduction per participant will be used to calculate the achievable potential
Demand Response Equations

Achievable Potential Calculation:

- If the model user chooses to base estimated potential demand reduction on percent of total per participant CP load, then:

\[
\text{Achievable Demand Response Potential} = \text{Potentially Eligible Customers} \times \text{Eligible Customer Participation Rate} \times \text{Per Customer CP Load for Eligible Customer Segment (kW)} \times \text{Percent CP Load Reduction per Participant}
\]

- If the model user chooses to base estimated potential demand reduction on a per customer CP load reduction value, then:

\[
\text{Achievable Demand Response Potential} = \text{Potentially Eligible Customers} \times \text{Eligible Customer Participation Rate} \times \text{Per Customer CP Load Reduction for Eligible Customer Segment (kW)}
\]
Final Q&A
and Next Steps
Thank You
APPENDIX
IRP Acronyms

Note: A glossary of acronyms with definitions is available at https://www.aesindiana.com/integrated-resource-plan.
**IRP Acronyms**

- **ACEE:** The American Council for an Energy-Efficient Economy
- **AMI:** Advanced Metering Infrastructure
- **BESS:** Battery Energy Storage System
- **BNEF:** Bloomberg New Energy Finance
- **BTA:** Build-Transfer Agreement
- **C&I:** Commercial and Industrial
- **CAA:** Clean Air Act
- **CAGR:** Compound Annual Growth Rate
- **CCGT:** Combined Cycle Gas Turbines
- **CCS:** Carbon Dioxide Capture and Storage
- **CDD:** Cooling Degree Day
- **COD:** Commercial Operation Date
- **CONE:** Cost of New Entry
- **CP:** Coincident Peak
- **CPCN:** Certificate of Public Convenience and Necessity
- **CT:** Combustion Turbine
- **CVR:** Conservation Voltage Reduction
- **DER:** Distributed Energy Resource
- **DG:** Distributed Generation
- **DGPV:** Distributed Generation Photovoltaic System
- **DLC:** Direct Load Control
- **DOE:** U.S. Department of Energy
- **DR:** Demand Response
- **DRR:** Demand Response Resource
- **DSM:** Demand-Side Management
- **DSP:** Distribution System Planning
- **EE:** Energy Efficiency
- **EFORd:** Equivalent Forced Outage Rate Demand
- **EIA:** Energy Information Administration
- **ELCC:** Effective Load Carrying Capability
- **EM&V:** Evaluation Measurement and Verification
- **EV:** Electric Vehicle
- **GDP:** Gross Domestic Product
- **GT:** Gas Turbine
- **HDD:** Heating Degree Day
- **HVA:** Heating, Ventilation, and Air Conditioning
- **IAC:** Indiana Administrative Code
- **IC:** Indiana Code
- **ICAP:** Installed Capacity
- **ICE:** Internal Combustion Engine
- **IRP:** Integrated Resource Plan
- **ITC:** Investment Tax Credit
- **IURC:** Indiana Regulatory Commission
- **kW:** Kilowatt
- **kWh:** Kilowatt-Hour
- **LED:** Light Emitting Diode
- **LMR:** Load Modifying Resource
- **LNBL:** Lawrence Berkeley National Laboratory
- **Max Gen:** Maximum Generation Emergency Warning
- **MIP:** Mixed Integer Programming
- **MISO:** Midcontinent Independent System Operator
- **MPS:** Market Potential Study
- **MW:** Megawatt
- **NDA:** Nondisclosure Agreement
- **NOX:** Nitrogen Oxides
- **NREL:** National Renewable Energy Laboratory
- **PPA:** Power Purchase Agreement
- **PRA:** Planning Resource Auction
- **PTC:** Renewable Electricity Production Tax Credit
- **PRMR:** Planning Reserve Margin Requirement
- **PV:** Photovoltaic
- **PVRR:** Present Value Revenue Requirement
- **PY:** Planning Year
- **RA:** Resource Adequacy
- **RAN:** Resource Availability and Need
- **REC:** Renewable Energy Credit
- **REP:** Renewable Energy Production
- **RFP:** Request for Proposals
- **RIIA:** MISO’s Renewable Integration Impact Assessment
- **SAC:** MISO’s Seasonal Accredited Capacity
- **SCR:** Selective Catalytic Reduction System
- **SMR:** Small Modular Reactors
- **ST:** Steam Turbine
- **SUFG:** State Utility Forecasting Group
- **TRM:** Technical Resource Manual
- **UCT:** Utility Cost Test
- **UCAP:** Unforced Capacity
- **WTP:** Willingness to Participate
- **XEFORd:** Equivalent Forced Outage Rate Demand excluding causes of outages that are outside management control
2022 Integrated Resource Plan (IRP)

Public Advisory Meeting #2
4/12/2022
Agenda and Introductions

Stewart Ramsay, Managing Executive, Vanry & Associates
## Agenda

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<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>Speakers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Morning</strong></td>
<td></td>
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<tr>
<td><strong>Starting at 10:00 AM</strong></td>
<td>Virtual Meeting Protocols and Safety, Schedule</td>
<td>Chad Rogers, Senior Manager, Regulatory Affairs, AES Indiana</td>
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<tr>
<td></td>
<td>Meeting #1 Recap</td>
<td>Erik Miller, Manager, Resource Planning, AES Indiana</td>
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<td>Load Scenarios</td>
<td>Mike Russo, Forecast Consultant, Itron</td>
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<td>Eric Fox, Director, Forecasting Solutions, Itron</td>
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<td></td>
<td>MPS Results &amp; DSM Resources</td>
<td>Jeffrey Huber, Overall Project Manager and MPS Lead, GDS Associates</td>
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<td></td>
<td><strong>Break</strong></td>
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<td>12:00 PM – 12:30 PM</td>
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<td>Lunch</td>
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<td><strong>Afternoon</strong></td>
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<tr>
<td><strong>Starting at 12:30 PM</strong></td>
<td>Current Generation Portfolio Overview</td>
<td>Kristina Lund, President &amp; CEO, AES Indiana</td>
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<td>Replacement Resource Assumptions</td>
<td>Erik Miller, Manager, Resource Planning, AES Indiana</td>
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<td>IRP Portfolio Matrix &amp; Scenario Framework</td>
<td>Erik Miller, Manager, Resource Planning, AES Indiana</td>
</tr>
<tr>
<td></td>
<td>Final Q&amp;A and Next Steps</td>
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</tbody>
</table>

*Distribution System Planning was included on a prior distributed agenda. This topic will be covered in Public Advisory Meeting #3.*
Virtual Meeting Protocols and Safety

Chad Rogers, Senior Manager, Regulatory Affairs, AES Indiana
IRP Team Introductions

AES Indiana Leadership Team
Kristina Lund, President & CEO, AES Indiana
Aaron Cooper, Chief Commercial Officer, AES Indiana
Brandi Davis-Handy, Chief Public Relations Officer, AES Indiana
Ahmed Pasha, Chief Financial Officer, AES Indiana
Tom Raga, Vice President Government Affairs, AES Indiana
Judi Sobecki, General Counsel and Chief Regulatory Officer, AES Indiana

AES Indiana Planning Team
Joe Bocanegra, Load Forecasting Analyst, AES Indiana
Erik Miller, Manager, Resource Planning, AES Indiana
Scott Perry, Manager, Regulatory Affairs, AES Indiana
Chad Rogers, Senior Manager, Regulatory Affairs, AES Indiana
Brent Selvidge, Engineer, AES Indiana
Will Vance, Senior Analyst, AES Indiana

AES Indiana IRP Partners
Patrick Burns, PV Modeling Lead and Regulatory/IRP Support, Brightline Group
Eric Fox, Director, Forecasting Solutions, Itron
Jeffrey Huber, Overall Project Manager and MPS Lead, GDS Associates
Jordan Janflone, EV Modeling Forecasting, GDS Associates
Stewart Ramsey, Managing Executive, Vanry & Associates
Mike Russo, Forecast Consultant, Itron
Jacob Thomas, Market Research and End-Use Analysis Lead, GDS Associates
Melissa Young, Demand Response Lead, GDS Associates

AES Indiana Legal Team
Nick Grimmer, Indiana Regulatory Counsel, AES Indiana
Teresa Morton Nyhart, Counsel, Barnes & Thornburg LLP
Welcome to Today’s Participants

ACES
Advanced Energy Economy
Barnes & Thornburg LLP
Boardwalk Pipelines
Butler University
CCR
CenterPoint Energy
Citizens Action Coalition
City of Indianapolis
Clean Grid Alliance
Develop Indy | Indy Chamber
Duke Energy
E&C
EDP Renewables NA
Energy Futures Group
Faith in Place
Fluence Energy
GDS Associates
Hallador Energy

Hoosier Energy
IBEW LOCAL UNION 1395
Indiana Chamber
Indiana Energy Association
Indiana Utility Regulatory Commission
IUPUI
NuScale Power
Office of Utility Consumer Counselor
Purdue - State Utility Forecasting Group
Rolls-Royce/ISS
Sierra Club
Wartsila

… and members of the AES Indiana team and the public!
Virtual Meeting Best Practices

Questions

➔ Your candid feedback and input is an integral part to the IRP process.
➔ Questions or feedback will be taken at the end of each section.
➔ Feel free to submit a question in the chat function at any time and we will ensure those questions are addressed.

Audio

➔ All lines are muted upon entry.
➔ For those using audio via Teams, you can unmute by selecting the microphone icon.
➔ If you are dialed in from a phone, press *6 to unmute.

Video

➔ Video is not required. To minimize bandwidth, please refrain from using video unless commenting during the meeting.
AES Purpose & Values

Accelerating the future of energy, together.

Safety first

Highest standards

All together
Make your virtual environment safer

1. Secure Your Accounts
Use unique, complex passphrases and enable two-factor authentication wherever possible.

2. Think before you click
Think before you click on a link, file, or attachment on your laptop and mobile.

3. Know Your Network
Protect your home network by changing default passwords; use a VPN when conducting sensitive transactions or on public WiFi.

4. Protect your Device
Patch your devices regularly and be mindful of connecting unauthorized hardware like USB drives.

5. Share Data Responsibly
Control your social media settings and be mindful when posting publicly.

6. Be Safe by Being Prepared
Know the cyberattack types and report anything suspicious.
Meeting #1 Recap

Erik Miller, Manager, Resource Planning, AES Indiana
Updated 2022 IRP Timeline

AES Indiana is available for additional touchpoints with stakeholders to discuss IRP-related topics.
Public Advisory Schedule

- **Public Advisory Meeting #1 – January 24, 2022**
  - 2022 IRP Schedule & Progress
  - 2019 IRP Recap
  - Load, EV, DG Forecasts
  - MPS Overview

- **Public Advisory Meeting #2 – April 12, 2022**
  - Load Scenarios
  - MPS Results & DSM Inputs
  - Replacement Resource Assumptions
  - IRP Portfolio Matrix & Scenario Framework

- **Public Advisory Meeting #3 - June**
  - Portfolio Metrics & Scorecard Framework
  - Overview of Reliability in Indiana
  - Reliability Analysis
  - Distribution System Plan

- **Public Advisory Meeting #4 - August**
  - Preliminary Modeling Results
  - Risk Analysis
  - Portfolio Metrics & Scorecard Review

- **Public Advisory Meeting #5 - October**
  - 2022 Modeling Insights
  - Preferred Resource Portfolio & Short-Term Action Plan

Topics for meetings 3-5 are subject to change depending on modeling progress.
2022 Integrated Resource Plan (IRP)

Load Scenarios

Presented by Itron
Load Scenarios

High/Low Load Model Drivers

Mike Russo, Forecast Consultant, Itron
Modeling Approach

- Bottom-up Modeling Approach
- Estimate rate-class level sales and customer models from historical billed sales data
- Sales/energy driven by households, economic forecasts, expected weather conditions, price, and end-use efficiency improvements. End-use demand drives system peak demand

Monthly sales and customer models are estimated for:
- Residential
- Commercial
- Industrial
- Other (Lighting)

Monthly peak model driven by end-use energy forecasts

The baseline forecast excludes behind the meter solar, electric vehicle loads, and future EE program savings
Economic Based Scenarios

Baseline Forecast

→ Baseline forecast models use economic concepts from Moody’s Analytics Baseline Forecast, Aug 2021. Moody’s defines their baseline forecast as “the probability that the economy will perform better than this projection is equal to 50%, the same as the probability that it will perform worse”.

Low Forecast Scenario

→ Based on Moody’s S3: Alternative Scenario 3 – Downside – 90th Percentile: In this scenario, there is a 90% probability that the economy will perform better, broadly speaking, and a 10% probability that it will perform worse.

High Forecast

→ Based on Moody’s S1: Alternative Scenario 1 – Upside – 10th Percentile: In this scenario, there is a 10% probability that the economy will perform better, broadly speaking, and a 90% probability that it will perform worse.
Construction of Scenario Economic Drivers

- Growth rates from the Moody’s Low/High scenarios are applied to the Baseline economic variables beginning in January 2022.

- The chosen methodology ensures the growth rates used are less than or equal to the Baseline growth rates in the Low case and greater than or equal to the Baseline growth rates in the High case.

- If this adjustment were not made Low case growth rates would be greater than the baseline in certain years, as seen below. This could result in the Low load forecast exceeding the Baseline load forecast.
Moody Analytics scenarios growth rates are noticeably different in the near-term but revert back to long-term growth rates.
C&I Economic Drivers

**Indianapolis Non-Manufacturing Employment**

- **Thousands**
- **Baseline**
- **Low**
- **High**

**Employment Growth Rate**

- **Low**
- **High**
- **Baseline**

**Indianapolis Non-Manufacturing Gross Regional Product**

- **Thousands Real $**
- **Baseline**
- **Low**
- **High**

**GDP Growth Rate**

- **Low**
- **High**
- **Baseline**
Forecast Scenarios
→ Models updated to include actuals through Dec 2021
→ Forecasts excludes energy efficiency programs (EE), electric vehicles, and solar impact
→ Low forecast results in a reduction of 461,928 MWh and 84 MW by 2042
→ High forecast results in an increase of 139,270 MWh and 26 MW by 2042
2022 Integrated Resource Plan (IRP)

DSM Market Potential Study
Introduction

Presented by IRP Partners
MPS Results & DSM Resources
Introduction to the DSM Process in the IRP

IURC Rules – 170 IAC 4-7-8-c-4
“Analysis showing Supply-side resources and demand-side resources have been evaluated on a consistent and comparable basis.”

Market Potential Study

Screen and Create Bundles

AES Indiana Resource Selection Modeling

Selected Bundles into RFP for Vendor(s)

File Portfolio of Programs with IURC

AES Indiana’s IRP modeling

DSM Filing

2024–2026 AES Indiana DSM Program Implementation
Agenda

→ MPS Recap
→ Energy Efficiency Potential
  • Overview of results
  • Sector-level results
  • Program potential
→ Demand Response Potential
  • Overview of results
  • Sector-level results
→ Developing DSM IRP Inputs
DSM Market Potential Study

MPS Recap

Jeffrey Huber, Overall Project Manager and MPS Lead, GDS Associates
Overall Market Potential Study Process

**LOAD DISAGGREGATION**
Sales by Market Segment
Consumption by End Use

**DATA COLLECTION**
New & Existing Primary Data,
Secondary Data Collection

**MARKET ADOPTION**
Historical Performance Short-term
and Long-term Market Barriers

---

**TECHNOLOGY CHARACTERISTICS**
Energy, Capacity, and Therm Unit Savings
Saturation Shares Codes and Standard
Updates Applicability Interactions

**COST-EFFECTIVENESS**
Load Shapes Avoided Cost Benefits
Measure Costs/Price Trends
## Energy Efficiency Potential Types

### TECHNICAL POTENTIAL
All technically feasible measures are incorporated to provide a theoretical maximum potential.

### ECONOMIC POTENTIAL
All measures are screened for cost-effectiveness using the UCT Test. Only cost-effective measures are included.

### ACHIEVABLE POTENTIAL
Cost-effective energy efficiency potential that can practically be attained in a real-world program delivery case, assuming that a certain level of market penetration can be attained.

### Types of Energy Efficiency Potential

<table>
<thead>
<tr>
<th>Not Technically Feasible</th>
<th>Not Cost-Effective</th>
<th>Market &amp; Adoption Barriers</th>
<th>TECHNICAL POTENTIAL</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>ECONOMIC POTENTIAL</td>
</tr>
<tr>
<td>Not Technically Feasible</td>
<td>Not Cost-Effective</td>
<td></td>
<td>ACHIEVABLE POTENTIAL</td>
</tr>
</tbody>
</table>

### MAXIMUM ACHIEVABLE POTENTIAL (MAP)
Incentives set up to 100% of incremental cost

### REALISTIC ACHIEVABLE POTENTIAL (RAP)
Incentives based on historical levels
Key Methodological Assumptions for MAP/RAP

01 Adoption Rates
Method for determining both the short-term and long-term adoption levels by key market segments

02 Incentives
Historical incentives are a key driver of the Realistic Achievable Potential (RAP) scenario

03 Non-Incentive Costs
Non-Incentive costs are included at both the MAP/RAP level

04 Program Mapping & NTG
Evaluated NTG results were incorporated to assess Program RAP
Willingness to Participate (WTP) Results

Residential Long-Term Adoption Rates by End Use and Incentive Level

C&I Long-Term Adoption Rates by End Use and Payback Period

**WTP data gives an indication of the relationship between utility intervention and customer acceptance/adoption of EE technologies**
DSM Market Potential Study Results

Energy Efficiency (EE) Potential
Initial Comments

Overall Comments (all sectors):

→ All savings are gross

→ Economic Screening is the UCT Test using current incentive levels and no administrative costs

→ Measure assumptions (savings / costs) are based on a review of current evaluated savings as well as savings from approved sources (i.e., EM&V results, Illinois TRM, MEMD, etc.)

→ Technical & Economic potential is a phased-in potential; *i.e. opportunities are dependent on stock turnover*

→ RAP scenario is based on current incentive levels and associated long-term adoption rates (informed by primary market research)

→ MAP scenario examines ability to move incentive levels higher than historical; *does not examine lowering incentives for measures that do not currently screen as cost-effective.*
Overview of Results – Cumulative Annual

Cumulative Annual Savings as a % of AES Indiana “Eligible” Sales

- **Technical**
  - 3-YR: 13%
  - 10-YR: 10%
  - 19-YR: 19%

- **Economic**
  - 3-YR: 34%
  - 10-YR: 28%
  - 19-YR: 13%

- **MAP**
  - 3-YR: 5%
  - 10-YR: 17%
  - 19-YR: 4%

- **RAP**
  - 3-YR: 42%
  - 10-YR: 34%
  - 19-YR: 24%
Residential Sector Results

Cumulative Annual Savings as a % of Residential Sales

- Technical: 16%, 39%, 47%
- Economic: 10%, 27%, 33%
- MAP: 4%, 14%, 23%
- RAP: 3%, 11%, 18%
Residential cumulative annual maximum achievable potential as a percentage of forecasted sales in 2042
(compared to 35% by 2039 in 2019 MPS; difference attributable to lower economic potential, updated saturation data and adoption rates)
Residential Realistic Achievable Potential (RAP)

2042 Cumulative Annual

- Appliances: 17%
- Behavior: 7%
- HVAC: 38%
- Lighting: 3%
- Pool/Pump: 6%
- New Construction: 5%
- Plug Loads: 3%
- Shell: 3%
- Water Heating: 19%

18%

Residential cumulative annual realistic achievable potential as a percentage of forecasted sales in 2042 (compared to 24% by 2039 in 2019 MPS; difference attributable to lower economic potential, updated saturation data and adoption rates)
Residential Incremental Annual Savings by End Use

MWh

2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042

Behavior Water Heating Lighting Appliances New Construction Plug Loads Pool/Pump Shell HVAC
C&I Opt-Outs

C&I “Opt-Out Sales” Adjustment

→ MPS uses only “eligible” sales for electric energy efficiency potential, removing sales from C&I customers who opt-out of the energy efficiency rider.

→ 28% of Commercial Sales were from opt-out customers in 2022

→ 76% of Industrial Sales were from opt-out customers in 2022

→ Savings (as a % of sales) are relative to “eligible” sales in subsequent slides
C&I Sector Results

Cumulative Annual Savings as a % of C&I Sales

- **Technical**: 9%, 29%, 36%
- **Economic**: 9%, 28%, 35%
- **MAP**: 7%, 19%, 25%
- **RAP**: 5%, 15%, 20%
C&I Maximum Achievable Potential (MAP)

2042 Cumulative Annual

- Lighting: 17%
- Refrigeration: 23%
- Whole Building: 2%
- Cooling: 7%
- Ventilation: 5%
- Motors: 8%
- Industrial: 9%
- Heating/Water Heating: 20%
- Miscellaneous: 10%

C&I Electric End Use Potential

25%

C&I cumulative annual maximum achievable potential as a percentage of forecasted sales in 2042
(compared to 36% by 2039 in 2019 MPS; primary difference in assumed MAP incentive assumptions and associated adoption levels)

**Other includes potential associated with cooking, compressed air, behavioral and other miscellaneous loads (elevators, vending machines, etc.)
C&I Realistic Achievable Potential (RAP)

2042 Cumulative Annual

- Lighting: 16%
- Refrigeration: 7%
- Whole Building: 2%
- Cooling: 22%
- Ventilation: 11%
- Motors: 6%
- Industrial: 6%
- Heating/Water: 6%
- Miscellaneous: 7%

**Other includes potential associated with cooking, compressed air, behavioral and other miscellaneous loads (elevators, vending machines, etc.)**

C&I Electric End Use Potential

C&I cumulative annual maximum achievable potential as a percentage of forecasted sales in 2042

(Compared to 19% by 2039 in 2019 MPS)
Developing Program Potential from RAP

Key differences between RAP and Program Potential:

Program Potential applies the most recent evaluated net-to-gross ("NTG") ratios to the RAP (overall reduction due to NTG <1.0).

<table>
<thead>
<tr>
<th>Residential Program</th>
<th>NTG Ratio</th>
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<tbody>
<tr>
<td>Efficient Products</td>
<td>80%</td>
</tr>
<tr>
<td>Home Energy Reports</td>
<td>100%</td>
</tr>
<tr>
<td>School Kits</td>
<td>63%</td>
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<tr>
<td>Income-Qualified Weatherization</td>
<td>89%</td>
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<tr>
<td>Appliance Recycling</td>
<td>70%</td>
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<tr>
<td>Multifamily</td>
<td>98%</td>
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<tr>
<td>Demand Response</td>
<td>100%</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>C&amp;I Programs</th>
<th>NTG Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prescriptive</td>
<td>74%</td>
</tr>
<tr>
<td>Custom</td>
<td>80%</td>
</tr>
<tr>
<td>Strategic Energy Management</td>
<td>100%</td>
</tr>
</tbody>
</table>
Comparison of RAP and Program Potential

![Comparison of RAP and Program Potential](image)
Annual Residential Program Potential
Annual C&I Program Potential

![Bar chart showing incremental annual MWh savings from 2021 to 2042 for different C&I program categories. The chart includes categories such as C&I-Custom SEM, C&I-Custom, C&I-Custom Light, C&I-Prescriptive, C&I-Prescriptive Light, and C&I-Custom RCx.]
Program Potential Non-Incentive Costs

Non-Incentive costs were developed using recent 2021-2022 actual program cost data. Program non-incentive costs were calculated on a gross $ per first-year kWh saved. Non-incentive costs were developed for each sector, and by program when possible.

Historical non-incentive cost categories include:

- Implementation
- Utility admin
- Indirect
- EM&V

![Pie chart showing cost distribution for 2021 and 2022]
C&I Program Potential Annual Costs

![Chart showing annual RAP budgets (C&I - Nominal) for different years from 2024 to 2042. The chart includes bars for incentives and admin costs.]

- Annual RAP Budgets (C&I - Nominal)
- Incentives and Admin costs for each year.

The chart shows a trend of increasing costs from 2024 to 2035, with a peak in 2036 and a decrease in subsequent years.

- AES Indiana
- 2022 IRP Report
- Attachment 1-2
- Page 169 of 647
DSM Market Potential Study Results

Demand Response (DR) Potential
Demand Response Overview

Measures Considered
Demand Response includes Direct Load Control (DLC), Behavior DR, Time of Use (TOU) Rates, Capacity Bidding, Demand Bidding and Interruptible Agreements.

→ In the residential sector, DLC includes central air conditioning, room air conditioning, electric space heating, water heating, smart appliances, and pool pumps

→ In the nonresidential sector, DLC includes air conditioning, electric space heating, lighting, and water heating

DR Hierarchies
DR analysis will account for interactive effects as additional types of demand response programs are added to the mix. The hierarchy for demand response programs in the base case for the four market sectors is as follows:

<table>
<thead>
<tr>
<th>Residential</th>
<th>Small C&amp;I</th>
<th>Large C&amp;I</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Direct Load Control</td>
<td>1. Direct Load Control</td>
<td>1. Interruptible Agreements</td>
</tr>
<tr>
<td>3. TOU</td>
<td>3. TOU</td>
<td>3. TOU</td>
</tr>
</tbody>
</table>
Demand Response Programs Considered

→ Direct Load Control ("DLC") – Central ACs
→ DLC – Room ACs
→ DLC – Smart Appliances
→ DLC – Water Heaters
→ DLC – Electric Space Heat
→ DLC – Lighting

→ Battery Energy Storage
→ Electric Vehicle Charging
→ Interruptible Agreements
→ Demand Bidding
→ Capacity Bidding
→ Time of Use Rates
→ Behavior DR
Residential Demand Response MAP/RAP Results

Peak MW Potential Savings in 2042

MAP
- DLC AC - Switch
- DLC Water Heating
- TOU with Enabling Technology

398 MW

RAP
- DLC AC - Thermostat
- DLC Electric Vehicles
- TOU without Enabling Technology

241 MW
C&I Demand Response MAP/RAP Results

Peak MW Potential Savings in 2042

MAP

157 MW

- Interruptible agreements
- Capacity Bidding
- TOU without Enabling Technology
- DLC AC - Thermostat
- DLC Space Heating
- DLC Water Heating
- TOU with Enabling Technology

RAP

78 MW
Annual Demand Response (RAP – by Sector)

INCREMENTAL ANNUAL

Peak MW Potential Savings

Incremental Annual Realistic Achievable Potential (MW)

- Residential
- C&I

2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042
DSM Market Potential Study

Developing DSM IRP Inputs
IRP Inputs – Energy Efficiency

Reference Case

→ EE Inputs for reference case will align with the Program RAP Potential

→ EE Inputs will be provided over three different vintages
  • 2024-2026 (3 years)
  • 2026-2028 (3 years)
  • 2029-2042 (13 years)

→ For 2024-2026 Vintage, EE Inputs will be bundled to closely resemble program offerings
  • For remaining vintages, EE Inputs will be aggregated at the sector level

→ EE Costs will include utility costs (incentives and non-incentive costs) and will be adjusted to reflect the NPV impacts of T&D benefits.

→ 2023 will be “hard coded” to align with current approved DSM Plan savings and costs
IRP Inputs – Energy Efficiency

MWh

2,500,000

2,000,000

1,500,000

1,000,000

500,000

0


C&I_2030–2042
Res_2030–2042
C&I_2027–2029
Res_2027–2029
C&I_SEM
C&I_Custom
C&I_Rx
Res_DR
Res_MF
Res_Recycle
Res_IQW
Res_School
Res_EffProd
Res_HER
IRP Inputs – Energy Efficiency

Time Differentiated Savings

→ Within a bundle/vintage, the EE Savings are broken out by end-use

→ Saving by end-use are mapped to 8,760 end-use load shape data, developed by National Renewable Energy Laboratory (NREL) and Lawrence Berkeley National Lab (LBL).
  • Residential sector includes 33 end-uses
  • Nonresidential sector includes 11 end-uses

→ Hourly savings shapes are provided so that the model captures the timing of savings relative to the AES Indiana system and peak periods.
IRP Inputs – Energy Efficiency

Example Commercial Loadshape Data

- Cooling
- Exterior Lighting
- Fans
- Heat Recovery
- Heat Rejection
- Heating
- Interior Equipment
- Interior Lighting
- Pumps
- Refrigeration
- Water Systems
IRP Inputs – Demand Response

→ Bundles for demand response follow the same vintages as Energy Efficiency

→ Demand response bundles created for four categories
  • Residential DLC
  • Residential Rates
  • C&I DLC/Aggregator
  • C&I Rates

→ DR bundles will include savings for both summer and winter peak, with summer peak savings potentially generally more significant
Break for Lunch
Current Generation
Portfolio Overview

Kristina Lund, President & CEO, AES Indiana
Current Portfolio

Petersburg

Harding Street

Eagle Valley

Wind/Solar/Batteries
Gradual change to the AES Indiana portfolio over time

2009-2015
Signed 100 MW PPA at Hoosier Wind Park in NW Indiana, 200 MW PPA at Lakefield Wind Farm in Minnesota and 96 MW PPA for solar in Indianapolis through Rate REP

2016
Retired 260 MW of coal at Eagle Valley

2016
Finalized refuel of 630 MW of coal-fired generation at Harding Street to natural gas

2018
Eagle Valley 671 MW Gas-Fired Combined Cycle Plant Completed

2021-2023
Retired (Unit 1) 220 MW of coal at Petersburg; Plans to retire (Unit 2) 401 MW of coal at Petersburg in 2023

2023 – 2024
Plans to complete 195 MW Hardy Hills Solar project and 250 MW + 180 MWh Petersburg Energy Center solar + storage project
AES Indiana seeks to partner with Pike County and City of Indianapolis to drive customer value and community impact of Petersburg and Harding Street Sites.
Replacement Resource Assumptions

Erik Miller, Manager, Resource Planning, AES Indiana
Commercially Available Replacement Resources

DSM/EE
- EE & DR Measures bundled into tranches for planning model selection

Wind
- Land-Based Wind

Solar
- Utility-Scale
- C&I
- Residential

Storage
- Utility-Scale standalone
- Solar + Storage

Natural Gas
- CCGT
- CT
- Reciprocating Engine/ICE
- Pete Refuel
Replacement Resource Assumptions are the key inputs that the planning model uses for selecting replacement resources when energy or capacity is needed.

Replacement Resource Assumptions include:

→ Overnight Capital Cost to construct ($/kW) – Costs associated with development and construction of resource

→ Operating Cost:
  • Fixed Operation & Maintenance (FOM) – Costs incurred whether plant is operating or not, e.g. staff cost, regular maintenance, administrative costs
  • Variable Operation & Maintenance (VOM) – Costs associated with electricity production, e.g. repair and replacement of parts

→ Operating Characteristics:

<table>
<thead>
<tr>
<th>Solar &amp; Wind</th>
<th>Storage</th>
<th>CT or CCGT (Natural Gas)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generation Profiles</td>
<td>Ramp Rates</td>
<td>Heat Rates</td>
</tr>
<tr>
<td>Effective Load Carrying Capability (ELCC)</td>
<td>Capacity Accreditation</td>
<td>Ramp Rates</td>
</tr>
<tr>
<td>MW Limits</td>
<td>MW and MWh Limits</td>
<td>Capacity Accreditation</td>
</tr>
<tr>
<td>Asset Useful Life</td>
<td>Asset Useful Life</td>
<td>MW Limits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Asset Useful Life</td>
</tr>
</tbody>
</table>
Methodology for Replacement Resource Cost Assumptions

Overview

AES Indiana used a combination of Sargent & Lundy’s (S&L) RFP review, Bloomberg New Energy Finance (BNEF), National Renewable Energy Labs (NREL) and Wood Mackenzie data to benchmark the starting year assumptions for replacement resources in this IRP.

Replacement Resource capital cost forecasts were calculated by averaging forecasts from NREL, BNEF and Wood Mackenzie or from S&L.

Sargent & Lundy’s (S&L) review of AES Indiana’s 2019 RFP

AES Indiana contracted S&L to administer the Company’s 2019 All-source RFP for generation.

As follow up to this work, S&L summarized the cost and operating components for the resources included in the 2019 All-source RFP to inform the 2022 IRP.

To supplement this review, S&L also reviewed and sourced their internal databases and a comprehensive list of public data sources.

Resources reviewed:

• Solar
• Wind
• Solar + Storage
• Standalone 4-hr Storage
• Combustion Turbine (Frame and Aeroderivative)
• Combined Cycle Gas Turbine
• Reciprocating Engine

Cost components reviewed:

• Capital Cost ($/kWac)
• Interconnection Cost ($/kWac)
• Cost of Tax Equity ($/kWac)
• FOM ($/kWac)
• VOM ($/MWh)
• Capacity Factor (%)
• Curtailment (%)
• Property Tax ($/kWac)
• Max Capacity per year (MW)
2022 All-Source Generation RFP

AES Indiana is conducting an all-source RFP

→ Positions AES Indiana to efficiently procure generation consistent with final IRP Preferred Resource Portfolio
→ Informs IRP process in considering Replacement Resource Costs sensitivities
→ RFP offers requested for Commercial Operation Date (COD) of 2025-2027
→ Incorporate invitation for projects leveraging remaining uncommitted Petersburg Unit 2 injection rights
→ Issue RFP mid-April

Department of Commerce Anti-Dumping/Countervailing Duties (AD/CVD) investigation

→ Preliminary decision 150 days
→ Repercussions for solar industry
→ Creates uncertainty for developers – particularly in near-term
→ Issue resolution for 2025-2027 COD projects – address uncertainty around solar in RFP
## Sources for Replacement Resource Cost Assumptions

<table>
<thead>
<tr>
<th>Primary Assumption</th>
<th>Wind</th>
<th>Solar</th>
<th>Storage</th>
<th>Solar + Storage</th>
<th>CCGT</th>
<th>Frame CT</th>
<th>Aero CT</th>
<th>Reciprocating Engine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed O&amp;M</td>
<td>Company Assets</td>
<td>Company Assets</td>
<td>Company Assets</td>
<td>Company Assets</td>
<td>Company Assets</td>
<td>Company Assets</td>
<td>Sargent &amp; Lundy</td>
<td>Sargent &amp; Lundy</td>
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<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Company Assets</td>
<td>Company Assets</td>
<td>Sargent &amp; Lundy</td>
<td>Sargent &amp; Lundy</td>
</tr>
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<td>Operating Characteristic</td>
<td>NREL System Advisory Model (SAM)</td>
<td>NREL System Advisory Model (SAM)</td>
<td>NREL 2021 ATB</td>
<td>NREL 2021 ATB</td>
<td>Company Assets</td>
<td>Company Assets</td>
<td>Sargent &amp; Lundy</td>
<td>Sargent &amp; Lundy</td>
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<tr>
<td>Other Key Assumption</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>ELCC / Capacity Credit</td>
<td>Horizons Energy / MISO</td>
<td>Horizons Energy / MISO</td>
<td>Horizons Energy / MISO</td>
<td>Horizons Energy / MISO</td>
<td>MISO</td>
<td>MISO</td>
<td>MISO</td>
<td>MISO</td>
</tr>
<tr>
<td>Grid Connection Cost</td>
<td>Sargent &amp; Lundy</td>
<td>Sargent &amp; Lundy</td>
<td>Sargent &amp; Lundy</td>
<td>Sargent &amp; Lundy</td>
<td>Sargent &amp; Lundy</td>
<td>Sargent &amp; Lundy</td>
<td>Sargent &amp; Lundy</td>
<td>Sargent &amp; Lundy</td>
</tr>
<tr>
<td>Tax Equity Cost</td>
<td>Sargent &amp; Lundy</td>
<td>Sargent &amp; Lundy</td>
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<td>Sargent &amp; Lundy</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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</table>
### Wind Capital and Operating Costs

<table>
<thead>
<tr>
<th>Capital Cost ($/kW)</th>
<th>Fixed O&amp;M ($/kW)</th>
<th>Variable O&amp;M ($/MWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$</td>
<td>1,451</td>
<td>30</td>
</tr>
<tr>
<td>$</td>
<td></td>
<td>$</td>
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</tbody>
</table>

**Capital Cost Forecast**

**Note:** Capital Cost estimates presented here are without federal tax credits. Federal tax credits will be included in modeling based on the IRP scenario assumptions.

**Note:** Confidential cost forecasts in chart include forecasts from NREL, Wood Mackenzie and BNEF
Wind Parameters

- **Location:** Indiana
- **Annual Capacity Factor:** 33.6 – 40.4%
- **Source Profile:** NREL System Advisory Model (SAM)
- **Project Size:** 50 MW ICAP
- **Useful Life:** 30 years
- **Summer ELCC (2025):** 7.1%; 
  *Source: Horizons Energy*
- **Winter ELCC:** 20%; 
  *Source: MISO RAN*
### Solar Capital and Operating Costs

<table>
<thead>
<tr>
<th>Capital Cost ($/kW)</th>
<th>Fixed O&amp;M ($/kW)</th>
<th>Variable O&amp;M ($/MWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1,111</td>
<td>$12</td>
<td>$0</td>
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</table>

**Note:** Capital Cost estimates presented here are without federal tax credits. Federal tax credits will be included in modeling based on the IRP scenario assumptions.

**Note:** Confidential cost forecasts in chart include forecasts from NREL, Wood Mackenzie and BNEF.
Solar Parameters

- **Location**: Petersburg, Indiana
- **Annual Capacity Factor**: 24.5%
- **Source Profile**: NREL System Advisory Model (SAM)
- **Project Size**: 25 MW ICAP
- **Useful Life**: 35 years
- **Summer ELCC (2025)**: 58.7%; *Source: Horizon Energy*
- **Winter ELCC**: 0%; *Source: MISO RAN*

*Summer ELCC forecast presented in chart is from the Horizon Custom Reference Case – ELCC forecast will vary by custom scenario*
# Storage Capital and Operating Costs

<table>
<thead>
<tr>
<th>Capital Cost ($/kW)</th>
<th>Fixed O&amp;M ($/kW)</th>
<th>Variable O&amp;M ($/MWh)</th>
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</thead>
<tbody>
<tr>
<td>$</td>
<td>1,130</td>
<td>27</td>
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</table>

## Capital Cost Forecast

Note: Capital Cost estimates presented here are without federal tax credits. Federal tax credits will be included in modeling based on the IRP scenario assumptions.

Note: Confidential cost forecasts in chart include forecasts from Wood Mackenzie and BNEF.
Storage Parameters

- **Location:** Indianapolis, Indiana
- **Project Size:** 20 MW ICAP | 80 MWh (4-hour)
- **Round Trip Efficiency (RTE):** 85%
- **Useful Life:** 20 years
- **Summer/Winter Capacity Accreditation:** 95% (19 MW)

Note: 6-hour Storage also be modeled and scaled off of the 4-hour Storage assumptions
Solar + Storage Capital and Operating Costs

<table>
<thead>
<tr>
<th>Capital Cost ($/kW)</th>
<th>Fixed O&amp;M ($/kW)</th>
<th>Variable O&amp;M ($/MWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1,069</td>
<td>$17</td>
<td>$0</td>
</tr>
</tbody>
</table>

**Capital Cost Forecast**

**Note:** Capital Cost estimates presented here are without federal tax credits. Federal tax credits will be included in modeling based on the IRP scenario assumptions.
Solar + Storage Parameters

- **Location:** Petersburg, Indiana
- **System:** DC Coupled Solar + Storage System, Storage charges exclusively from the solar array
- **Solar Component:** Identical to stand-alone solar (25 MW ICAP)
- **Storage Component:** 12.5 MW ICAP | 50 MWh
- **Synergies:** 4.3% reduction in capital costs, 2% improvement of RTE
- **Summer ELCC (2025):** 100%
- **Winter ELCC:** 48%

*Summer forecast presented in chart above is from the Horizon Custom Reference Case – forecast will vary by custom scenario*
## CCGT Capital and Operating Costs

<table>
<thead>
<tr>
<th>Capital Cost ($/kW)</th>
<th>Fixed O&amp;M ($/kW)</th>
<th>Variable O&amp;M ($/MWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1,026</td>
<td>$32</td>
<td>$2</td>
</tr>
</tbody>
</table>

### Capital Cost Forecast

Note: Confidential cost forecasts in chart include forecasts from NREL, Wood Mackenzie and BNEF

AES Indiana
2022 IRP Report
Attachment 1-2
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CCGT Parameters

- Project Size: 325 MW ICAP
- Heat Rate at Max Economic Load: 6,700 Btu/kWh
- Useful Life: 30 years
- Summer/Winter Capacity Credit: 94.2% static
Frame Combustion Turbine Capital and Operating Costs

<table>
<thead>
<tr>
<th>Capital Cost ($/kW)</th>
<th>Fixed O&amp;M ($/kW)</th>
<th>Variable O&amp;M ($/MWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$872</td>
<td>$30</td>
<td>$1</td>
</tr>
</tbody>
</table>

**Capital Cost Forecast**

Note: Confidential cost forecasts in chart include forecasts from NREL, Wood Mackenzie and BNEF.
Frame Combustion Turbine Parameters

- **Project Size:** 100 MW ICAP
- **Heat Rate at Max Economic Load:** 10,000 Btu/kWh
- **Useful Life:** 20 years
- **Summer/Winter Capacity Credit:** 95.6% static
Aero CT and Recip Engine Capital and Operating Costs

<table>
<thead>
<tr>
<th></th>
<th>Capital Cost ($/kW)</th>
<th>Fixed O&amp;M ($/kW)</th>
<th>Variable O&amp;M ($/MWh)</th>
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</thead>
<tbody>
<tr>
<td>Aero CT</td>
<td>$1,335</td>
<td>$36</td>
<td>$5</td>
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<tr>
<td>Recip</td>
<td>$1,283</td>
<td>$46</td>
<td>$6</td>
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</table>

Capital Cost Forecast

Aeroderivative CT
Reciprocating Engine
Aero CT and Reciprocating Engine Parameters

Aero Combustion Turbine

- **Project Size:** 90 MW ICAP
- **Heat Rate at Max Economic Load:** 8,200 Btu/kWh
- **Useful Life:** 20 years
- **Summer/Winter Capacity Credit:** 95.6% static

Reciprocating Engine

- **Project Size:** 54 MW ICAP
- **Heat Rate at Max Economic Load:** 7,400 Btu/kWh
- **Useful Life:** 20 years
- **Summer/Winter Capacity Credit:** 95.6% static
Petersburg Refuel Capital and Operating Costs

Petersburg Units 3 & 4 Refuel to Natural Gas

- Low capital cost (~$100/kW)
- Refueling will require gas infrastructure upgrade not included in capital cost above

Modeling Assumptions

Costs:

- Capital expenditure estimated based on cost to refuel Harding Street 5, 6, 7
- Engineering analysis performed to understand the cost for gas infrastructure upgrade

Potential Refueling Benefits

- Reduces carbon intensity (lower capacity factor and emission rate for ST gas – similar to Harding St)
- Dispatchable resource that positions AES Indiana well with new MISO seasonal capacity construct
Refuel of Petersburg Units 3 & 4 Parameters

→ Petersburg Unit 3
  • Project Size: 526 MW ICAP
  • Heat Rate at Max Economic Load: 10,800 Btu/kWh
  • Variable O&M: < $0.50/MWh
  • Fixed O&M: 65% reduction from coal Fixed O&M
  • Useful Life: 20 years
  • Summer/Winter Capacity Credit: 90.9% static

→ Petersburg Unit 4
  • Project Size: 526 MW ICAP
  • Heat Rate at Max Economic Load: 10,800 Btu/kWh
  • Variable O&M: < $0.50/MWh
  • Fixed O&M: 65% reduction from coal Fixed O&M
  • Useful Life: 20 years
  • Summer/Winter Capacity Credit: 94.1% static
IRP Portfolio Matrix

Introduction

Erik Miller, Manager, Resource Planning, AES Indiana
AES Indiana’s Portfolio Matrix considers four generation portfolio Strategies across four Scenarios

**Strategies**

- AES Indiana’s potential future strategies for the generation portfolio.
- Retirement dates, capital expenditures & cost treatments are anticipated and defined for each strategy and included in the planning model.

**Scenarios**

- Scenarios are views of the future defined by external influences like political outcomes, economics, regulations, etc.
- In the planning model, each scenario will have a unique set of input assumptions that correspond to the external influences defining the scenario.

*Note that AES Indiana will also use stochastics & sensitivities to assess risk around particular variables, e.g. replacement resource costs.*
IRP Strategies
Generation Portfolio Strategies

- **No Changes to Existing Portfolio**
  - Status quo
  - Units remain in service through useful life of 2042

- **Petersburg Refuel**
  - Petersburg Unit 3 & 4 refueled to Natural Gas in 2025
  - Natural gas pipeline already present on site

- **One Petersburg unit retires early (2026)**
  - One unit retired early in 2026
  - The other unit remains in service through useful life of 2042
  - Replacement capacity starting in 2026

- **Both Petersburg units retire early (2026 & 2028)**
  - One unit retires early in 2026
  - The other unit retires early in 2028
## Rationale for Predefined Portfolio Strategies

<table>
<thead>
<tr>
<th>Generation Portfolio Strategy</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Changes to Existing Portfolio</td>
<td>Provides portfolios with coal through 2042 for Scorecard metric comparison &amp; evaluation</td>
</tr>
<tr>
<td>Petersburg Refuel</td>
<td>Earliest possible refuel date that provides sufficient lead time to execute the natural gas conversion</td>
</tr>
<tr>
<td>One Petersburg Unit Retires Early (2026)</td>
<td>Earliest possible retirement date that provides sufficient lead time to procure capacity</td>
</tr>
<tr>
<td>Both Petersburg Units Retire Early (2026 &amp; 2028)</td>
<td>Staggering specific unit retirement dates provides sufficient lead time to procure capacity</td>
</tr>
</tbody>
</table>

Predefined strategies provide for comparison and evaluation of portfolios with the earliest possible exit from coal vs portfolios with coal through the entire planning period.

**Note:** To support decision making, AES Indiana will perform capacity expansion analysis without specified dates that allows the Encompass model to fully optimize retirements and replacements; however, outcomes from this analysis may not be viable and/or reasonable.
Strategy: No Changes to Existing Portfolio

Capacity Expansion optimally fills shortfall
Strategy: Petersburg Refuel in 2025

Capacity Expansion optimally fills shortfall
Strategy: One Petersburg Unit Retires

Capacity Expansion optimally fills shortfall
Strategy: Both Petersburg Units Retire

Capacity Expansion optimally fills shortfall
IRP Scenario Framework & Driving Assumptions
AES Indiana will model the four strategies for the generation portfolio across four scenarios:

A. No Environmental Action – “NoEnv”

B. Current Trends (Reference Case) – “Ref”

C. Aggressive Environmental – “AE”

D. Decarbonized Economy – “Decarb”
AES Indiana has contracted Horizons Energy to produce custom fundamental commodity forecasts for the four IRP Scenarios – No Environmental Action, Current Trends (Reference Case), Aggressive Environmental and Decarbonized Economy.

- Horizons Energy is modeling AES Indiana’s environmental policy and fuel price assumptions associated with each scenario to produce scenario-specific fundamental forecasts for the MISO system.

- Horizons Energy uses the EnCompass model for capacity expansion of the MISO System in producing the custom fundamental forecasts.

- Fundamental Curve modeling results include:
  - ATC, On-Peak and Off-Peak Power Prices
  - Capacity Prices

- The No Environmental Action, Current Trends (Reference Case), Aggressive Environmental and Decarbonized Economy custom fundamental forecasts are currently in production with Horizons Energy.
Scenario “NoEnv”: No Environmental Action

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Load</th>
<th>EV</th>
<th>PV</th>
<th>Power</th>
<th>Gas</th>
<th>Coal</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Environmental Action</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>TBD</td>
<td>Low</td>
<td>Base</td>
<td>None</td>
</tr>
</tbody>
</table>

**Scenario Narrative**

→ Future defined by relaxed environmental regulations, expanded fracking and low demand with low electrification.

→ Inflation persists driving low GDP & customer growth.

→ Continued coal operation combined with expanded gas production result in low gas prices.
Scenario “NoEnv”: No Environmental Action – Load Assumptions

**Load Forecast:**
Low Case
Driven by Moody’s Economics S3:
Alternative Scenario 3 – Downside – 90th Percentile

**Electric Vehicle Forecast:**
Low Case
EV market share of 12% in 2042

**Distributed Solar Forecast:**
Low Case
Market adoption of 6% in 2042

---

**Note:** Load forecast excludes future DSM - this will be modeled as a resource in the IRP model.
Scenario “NoEnv”: No Environmental Action – Environmental Policy Assumptions

**ITC:** No subsidy extension; Current tax subsidy schedule – declines to 10% by 2028 and remains at 10% through analysis period

**PTC:** No subsidy extension; Current tax subsidy schedule – safe harbor period expires in 2027

**Carbon:** None

**Additional Coal-fired Production Costs:** None

*Years correspond to years projects first produce energy*
Scenario “Ref”: Current Trends (Reference Case)

### Driving Assumptions

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Load</th>
<th>EV</th>
<th>PV</th>
<th>Power</th>
<th>Gas</th>
<th>Coal</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Trends</td>
<td>Base</td>
<td>Base</td>
<td>Base</td>
<td>TBD</td>
<td>Base</td>
<td>Base</td>
<td>Low</td>
</tr>
</tbody>
</table>

### Scenario Narrative

- Congressional gridlock persists with stalled progress on passing sweeping environmental legislation.
- The ITC and PTC given single year extensions for the next five years.
- Assumes modest price for carbon starting at $6.49/ton in the late 2020s.
Scenario “Ref”: Current Trends – Load Assumptions

**Load Forecast:**
Base Case with base Moody’s economic assumptions

**Electric Vehicle Forecast:**
Base Case
EV market share of 22% in 2042

**Distributed Solar Forecast:**
Base Case
Market adoption of 15% in 2042

Note: Load forecast excludes future DSM - this will be modeled as a resource in the IRP model
Scenario “Ref”: Current Trends – Environmental Policy Assumptions

**ITC**: Five-year extension – declines to 10% by 2032 and remains at 10% through analysis period

**PTC**: Five-year extension – safe harbor period expires in 2032

**Carbon**: Carbon set at $6.49/ton starting in 2028 and escalating at 2.5% through planning period; Carbon price consistent with 1/3 the value of the Social Cost of Carbon as calculated by the U.S. Govt Interagency Working Group on Social Cost of Greenhouse Gases

**Additional Coal-fired Production Costs**: None

---

*Years correspond to years projects first produce energy

---

Scenario “AE”: Aggressive Environmental

Scenario Narrative

→ Congress passes environmental legislation that includes carbon tax starting in 2035.
→ ITC and PTC extensions are consistent with Build Back Better.
→ Includes high demand scenario with high electric vehicle and solar forecasts
→ Near term transition from coal to natural gas results in high gas prices.
Scenario “AE”: Aggressive Environmental – Load Assumptions

**Load Forecast:**
High Case driven by Moody’s S1: Alternative Scenario 1 – Upside – 10th Percentile

**Electric Vehicle Forecast:**
High Case
EV market share of 44% in 2042

**Distributed Solar Forecast:**
High Case
Market adoption of 29% in 2042

---

**Final Scenario Peak Forecast w/ Reserve Margin**

**Note:** Load forecast excludes future DSM - this will be modeled as a resource in the IRP model.
Scenario “AE”: Aggressive Environmental – Environmental Policy Assumptions

**ITC**: Ten-year extension – declines to 10% by 2042 and remains at 10% through analysis period

**PTC**: Ten-year extension – safe harbor period expires in 2042

**Carbon**: Carbon set at $26.64/ton starting in 2035 and escalating at 5% through planning period; Carbon price consistent with the whole value of the Social Cost of Carbon as calculated by the U.S. Govt Interagency Working Group on Social Cost of Greenhouse Gases.

**Additional Coal-fired Production Costs:**
1. Additional cost for coal ash disposal
2. High Ozone Season NOx price forecast

*Years correspond to years projects first produce energy*

Scenario “Decarb”: Decarbonized Economy

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Load</th>
<th>EV</th>
<th>PV</th>
<th>Power</th>
<th>Gas</th>
<th>Coal</th>
<th>CO2</th>
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</thead>
<tbody>
<tr>
<td>Decarbonized Economy</td>
<td>High</td>
<td>Very High</td>
<td>High</td>
<td>TBD</td>
<td>Base</td>
<td>Base</td>
<td>None*</td>
</tr>
</tbody>
</table>

*Carbon targets will be modeled through a National Renewable Portfolio Standard

**Scenario Narrative**

→ Congress passes aggressive decarbonization mandate on power sector with explicit renewable energy targets.

→ High ITC/PTC runs through planning horizon.

→ Carbon targets achieved through a Renewable Portfolio Standard that targets Net Zero; not a market mechanism like a carbon tax or cap and trade.

→ High load driven by electrification

→ Base gas prices driven by low demand due to reduced gas generation.
Scenario “Decarb”: Decarbonized Economy – Load Assumptions

**Load Forecast:**
High Case driven by Moody’s S1: Alternative Scenario 1 – Upside – 10th Percentile

**Electric Vehicle Forecast:**
Very High Case
EV market share of 85% in 2042

**Distributed Solar Forecast:**
High Case
Market adoption of 29% in 2042

Note: Load forecast excludes future DSM - this will be modeled as a resource in the IRP model
Scenario “Decarb”: Decarbonized Economy – Environmental Policy Assumptions

**ITC:** 30% throughout the planning period

**PTC:** 100% through entire period

**Carbon:** No price on Carbon; Renewable Portfolio Standard similar to Clean Energy Performance Program (CEPP)

**Additional Coal-fired Production Costs:**
1. Additional cost for coal ash disposal
2. High Ozone Season NOx price forecast

*Years correspond to years projects first produce energy*
## Summary of Scenario Driving Assumptions

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Load</th>
<th>EV</th>
<th>Dist Solar</th>
<th>Power</th>
<th>Gas</th>
<th>Coal</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Environmental Action – “No Env”</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>TBD</td>
<td>Low</td>
<td>Base</td>
<td>None</td>
</tr>
<tr>
<td>Current Trends (Reference Case) – “Ref”</td>
<td>Base</td>
<td>Base</td>
<td>Base</td>
<td>TBD</td>
<td>Base</td>
<td>Base</td>
<td>Low</td>
</tr>
<tr>
<td>Aggressive Environmental – “AE”</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>TBD</td>
<td>High</td>
<td>Base</td>
<td>High</td>
</tr>
<tr>
<td>Decarbonized Economy – “Decarb”</td>
<td>High</td>
<td>Very High</td>
<td>High</td>
<td>TBD</td>
<td>Base</td>
<td>Base</td>
<td>None*</td>
</tr>
</tbody>
</table>

*Carbon targets will be modeled through a National Renewable Portfolio Standard
Final IRP Portfolio Matrix
Combining Strategies and Scenarios results in the Portfolio Matrix or framework for IRP evaluation:

<table>
<thead>
<tr>
<th>Generation Strategies</th>
<th>No Environmental Action</th>
<th>Current Trends (Reference Case)</th>
<th>Aggressive Environmental</th>
<th>Decarbonized Economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Early Retirement</td>
<td>No Retire/NoEnv</td>
<td>No Retire/Ref</td>
<td>No Retire/AE</td>
<td>No Retire/Decarb</td>
</tr>
<tr>
<td>Pete Refuel to 100% Gas (est. 2025)</td>
<td>Refuel/NoEnv</td>
<td>Refuel/Ref</td>
<td>Refuel/AE</td>
<td>Refuel/Decarb</td>
</tr>
<tr>
<td>One Pete Unit Retires (2026)</td>
<td>One Unit/NoEnv</td>
<td>One Unit/Ref</td>
<td>One Unit/AE</td>
<td>One Unit/Decarb</td>
</tr>
<tr>
<td>Both Pete Units Retire (2026 &amp; 2028)</td>
<td>Both Units/NoEnv</td>
<td>Both Units/Ref</td>
<td>Both Units/AE</td>
<td>Both Units/Decarb</td>
</tr>
</tbody>
</table>

→ The 16 portfolios defined above will be evaluated using a Scorecard that includes cost, environmental, reliability & risk metrics.
→ A Preferred Resource Portfolio will be selected using this rigorous Scorecard evaluation process.
Risk Analysis: Sensitivities & Stochastic

Risk Analysis

→ Key variable sensitivities
  • AES Indiana will model sensitivities for key variables to understand how the PVRR may change in a future where the variable looks very different from the IRP assumption, e.g. renewable capital cost sensitivity.

→ Portfolio sensitivities
  • AES Indiana will model environmental policy sensitivities on the optimized capacity expansion results from the Current Trends (Reference Case) to understand how the PVRR may change in a very different policy future.
  • The results will help to answer the question – “How would the optimized Reference Case perform in a very different policy future, e.g. Reference Case in a Decarbonized Economy future?”

→ Stochastic Analysis
  • AES Indiana will run a stochastic analysis on fuel prices, energy prices and load in order to understand the risk to PVRR in the Reference Case from these key IRP variables.

Further detail regarding the Risk Analysis will be presented in Public Advisory Meeting #3.
Final Q&A
and Next Steps
Public Advisory Meeting

→ All meetings will be available for attendance via Teams. Meetings in 2022 may also occur in-person.

→ A Technical Meeting will be held the week preceding each Public Advisory Meeting for stakeholders with nondisclosure agreements. Tech Meeting topics will focus on those anticipated at the next Public Advisory Meeting.

→ Meeting materials can be accessed at www.aesindiana.com/integrated-resource-plan.
Thank You
IRP Acronyms

Note: A glossary of acronyms with definitions is available at https://www.aesindiana.com/integrated-resource-plan.
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACEE</td>
<td>The American Council for an Energy-Efficient Economy</td>
</tr>
<tr>
<td>AMI</td>
<td>Advanced Metering Infrastructure</td>
</tr>
<tr>
<td>BESS</td>
<td>Battery Energy Storage System</td>
</tr>
<tr>
<td>BNEF</td>
<td>Bloomberg New Energy Finance</td>
</tr>
<tr>
<td>BTA</td>
<td>Build-Transfer Agreement</td>
</tr>
<tr>
<td>BTU</td>
<td>British Thermal Unit</td>
</tr>
<tr>
<td>C&amp;I</td>
<td>Commercial and Industrial</td>
</tr>
<tr>
<td>CAA</td>
<td>Clean Air Act</td>
</tr>
<tr>
<td>CAGR</td>
<td>Compound Annual Growth Rate</td>
</tr>
<tr>
<td>CCGT</td>
<td>Combined Cycle Gas Turbines</td>
</tr>
<tr>
<td>CCS</td>
<td>Carbon Dioxide Capture and Storage</td>
</tr>
<tr>
<td>CDD</td>
<td>Cooling Degree Day</td>
</tr>
<tr>
<td>COD</td>
<td>Commercial Operation Date</td>
</tr>
<tr>
<td>CONE</td>
<td>Cost of New Entry</td>
</tr>
<tr>
<td>CP</td>
<td>Coincident Peak</td>
</tr>
<tr>
<td>CPCN</td>
<td>Certificate of Public Convenience and Necessity</td>
</tr>
<tr>
<td>CT</td>
<td>Combustion Turbine</td>
</tr>
<tr>
<td>CVR</td>
<td>Conservation Voltage Reduction</td>
</tr>
<tr>
<td>DER</td>
<td>Distributed Energy Resource</td>
</tr>
<tr>
<td>DG</td>
<td>Distributed Generation</td>
</tr>
<tr>
<td>DGPV</td>
<td>Distributed Generation Photovoltaic System</td>
</tr>
<tr>
<td>DLC</td>
<td>Direct Load Control</td>
</tr>
<tr>
<td>DOE</td>
<td>U.S. Department of Energy</td>
</tr>
<tr>
<td>DR</td>
<td>Demand Response</td>
</tr>
<tr>
<td>DRR</td>
<td>Demand Response Resource</td>
</tr>
<tr>
<td>DSM</td>
<td>Demand-Side Management</td>
</tr>
<tr>
<td>DSP</td>
<td>Distribution System Planning</td>
</tr>
<tr>
<td>EE</td>
<td>Energy Efficiency</td>
</tr>
<tr>
<td>EFORd</td>
<td>Equivalent Forced Outage Rate Demand</td>
</tr>
<tr>
<td>EIA</td>
<td>Energy Information Administration</td>
</tr>
<tr>
<td>ELCC</td>
<td>Effective Load Carrying Capability</td>
</tr>
<tr>
<td>EM&amp;V</td>
<td>Evaluation Measurement and Verification</td>
</tr>
<tr>
<td>EV</td>
<td>Electric Vehicle</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GT</td>
<td>Gas Turbine</td>
</tr>
<tr>
<td>HDD</td>
<td>Heating Degree Day</td>
</tr>
<tr>
<td>HVAC</td>
<td>Heating, Ventilation, and Air Conditioning</td>
</tr>
<tr>
<td>IAC</td>
<td>Indiana Administrative Code</td>
</tr>
<tr>
<td>IC</td>
<td>Indiana Code</td>
</tr>
<tr>
<td>ICAP</td>
<td>Installed Capacity</td>
</tr>
<tr>
<td>ICE</td>
<td>Internal Combustion Engine</td>
</tr>
<tr>
<td>IRP</td>
<td>Integrated Resource Plan</td>
</tr>
<tr>
<td>ITC</td>
<td>Investment Tax Credit</td>
</tr>
<tr>
<td>IURC</td>
<td>Indiana Regulatory Commission</td>
</tr>
<tr>
<td>kW</td>
<td>Kilowatt</td>
</tr>
<tr>
<td>kWh</td>
<td>Kilowatt-Hour</td>
</tr>
<tr>
<td>LED</td>
<td>Light Emitting Diode</td>
</tr>
<tr>
<td>LMR</td>
<td>Load Modifying Resource</td>
</tr>
<tr>
<td>LNLB</td>
<td>Lawrence Berkeley National Laboratory</td>
</tr>
<tr>
<td>Max Gen</td>
<td>Maximum Generation Emergency Warning</td>
</tr>
<tr>
<td>MAP</td>
<td>Maximum Achievable Potential</td>
</tr>
<tr>
<td>MIP</td>
<td>Mixed Integer Programming</td>
</tr>
<tr>
<td>MISO</td>
<td>Midcontinent Independent System Operator</td>
</tr>
<tr>
<td>MPS</td>
<td>Market Potential Study</td>
</tr>
<tr>
<td>MW</td>
<td>Megawatt</td>
</tr>
<tr>
<td>NDA</td>
<td>Nondisclosure Agreement</td>
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<tr>
<td>NOX</td>
<td>Nitrogen Oxides</td>
</tr>
<tr>
<td>NPV</td>
<td>Net Present Value</td>
</tr>
<tr>
<td>NREL</td>
<td>National Renewable Energy Laboratory</td>
</tr>
<tr>
<td>NTG</td>
<td>Net to Gross</td>
</tr>
<tr>
<td>PPA</td>
<td>Power Purchase Agreement</td>
</tr>
<tr>
<td>PRA</td>
<td>Planning Resource Auction</td>
</tr>
<tr>
<td>PTC</td>
<td>Renewable Electricity Production Tax Credit</td>
</tr>
<tr>
<td>PRMR</td>
<td>Planning Reserve Margin Requirement</td>
</tr>
<tr>
<td>PV</td>
<td>Photovoltaic</td>
</tr>
<tr>
<td>PVRR</td>
<td>Present Value Revenue Requirement</td>
</tr>
<tr>
<td>PY</td>
<td>Planning Year</td>
</tr>
<tr>
<td>RA</td>
<td>Resource Adequacy</td>
</tr>
<tr>
<td>RAN</td>
<td>Resource Availability and Need</td>
</tr>
<tr>
<td>RAP</td>
<td>Realistic Achievable Potential</td>
</tr>
<tr>
<td>REC</td>
<td>Renewable Energy Credit</td>
</tr>
<tr>
<td>REP</td>
<td>Renewable Energy Production</td>
</tr>
<tr>
<td>RFP</td>
<td>Request for Proposals</td>
</tr>
<tr>
<td>RIIPA</td>
<td>MISO’s Renewable Integration Impact Assessment</td>
</tr>
<tr>
<td>SAC</td>
<td>MISO’s Seasonal Accredited Capacity</td>
</tr>
<tr>
<td>SCR</td>
<td>Selective Catalytic Reduction System</td>
</tr>
<tr>
<td>SMR</td>
<td>Small Modular Reactors</td>
</tr>
<tr>
<td>ST</td>
<td>Steam Turbine</td>
</tr>
<tr>
<td>SUFG</td>
<td>State Utility Forecasting Group</td>
</tr>
<tr>
<td>UCT</td>
<td>Utility Cost Test</td>
</tr>
<tr>
<td>UCAP</td>
<td>Unforced Capacity</td>
</tr>
<tr>
<td>WTP</td>
<td>Willingness to Participate</td>
</tr>
<tr>
<td>XEFORD</td>
<td>Equivalent Forced Outage Rate Demand excluding causes of outages that are outside management control</td>
</tr>
</tbody>
</table>
# Replacement Resource Cost Assumptions

## Summary Table (of all parameters by tech type)

<table>
<thead>
<tr>
<th>Fuel type:</th>
<th>Wind</th>
<th>Solar</th>
<th>Storage</th>
<th>Solar + Storage</th>
<th>CCGT</th>
<th>Frame CT</th>
<th>Aero CT</th>
<th>Reciprocating Engine</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unsubsidized Capital Cost ($/kWac):</strong></td>
<td>$1.451</td>
<td>$1.111</td>
<td>$1.310</td>
<td>$1.126</td>
<td>$1.026</td>
<td>$872</td>
<td>$1,335</td>
<td>$1,283</td>
</tr>
<tr>
<td><strong>Subsidized Capital Cost ($/kWac):</strong></td>
<td>$1.002</td>
<td>$803</td>
<td>N/A</td>
<td>$882</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Fixed O&amp;M ($/kW-yr):</td>
<td>$37</td>
<td>$21</td>
<td>$36</td>
<td>$25</td>
<td>$32</td>
<td>$30</td>
<td>$36</td>
<td>$46</td>
</tr>
<tr>
<td>Variable O&amp;M ($/MWh):</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$2</td>
<td>$1</td>
<td>$5</td>
<td>$6</td>
</tr>
<tr>
<td>Grid Connection Cost ($/kWac):</td>
<td>$26</td>
<td>$54</td>
<td>$59</td>
<td>$54</td>
<td>$30</td>
<td>$30</td>
<td>$30</td>
<td>$30</td>
</tr>
<tr>
<td><strong>Tax Equity Cost ($/kWac):</strong></td>
<td>$59</td>
<td>$59</td>
<td>N/A</td>
<td>$59</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

| Size (POI MW): | 50 | 25 | 20 MW | 80 MWh | 25 MW POI, 32.5 MWhdc Solar, 12.5 MW | 50 MWh Battery | 325 | 100 |
| Asset Useful Life (years): | 30 | 35 | 20 | 31 | 30 | 20 | 20 | 20 |
| Capacity Factor: | 33.6-40.4% | 24.5% | N/A | 20.0% | Varies | Varies | Varies | Varies |
| Summer ELCC (2025): | 7% | 59% | 96% | 100% | 94% | 96% | 96% | 96% |
| Summer Capacity Credit (2025): | 4 | 15 | 19 | 25 | 306 | 96 | 86 | 52 |
| Heat Rate at Max Econ Load (Btu/kWh): | N/A | N/A | N/A | N/A | 6,700 | 10,000 | 8,200 | 7,400 |
| Ramp Rate (MW/min): | N/A | N/A | N/A | N/A | 20 | 12 | 43 | 37 |
| WACC: | 6.7% | 6.7% | 6.7% | 6.7% | 6.7% | 6.7% | 6.7% | 6.7% |
| Estimated LCOE (2022$/MWh): | $30 | $38 | $113 | $53 | $44 | $120 | $69 | $61 |

*Includes 26% ITC for solar and $15/MWh PTC for wind consistent with the Current Trends Scenario
**Cost only considered when resource is subsidized
***Storage LCOS assumes one full discharge per day; Dispatchable resources LCOE calculations highly dependent on capacity factor
DSM Market Potential Study

APPENDIX SLIDES
## Demand Response Assumptions – Residential Load Reduction

<table>
<thead>
<tr>
<th>Program</th>
<th>Residential Load Reduction Per Participant</th>
</tr>
</thead>
<tbody>
<tr>
<td>DLC Central AC Switch</td>
<td>0.972 kW</td>
</tr>
<tr>
<td>DLC Central AC Thermostat</td>
<td>0.846 kW</td>
</tr>
<tr>
<td>DLC Smart Appliances</td>
<td>0.072 kW</td>
</tr>
<tr>
<td>DLC Water Heaters</td>
<td>0.4 kW Summer, 0.8 kW Winter</td>
</tr>
<tr>
<td>DLC Electric Space Heaters</td>
<td>1 kW</td>
</tr>
<tr>
<td>DLC Electric Vehicle Chargers</td>
<td>0.63 kW</td>
</tr>
<tr>
<td>Battery Energy Storage</td>
<td>3 kW</td>
</tr>
<tr>
<td>Time of Use Rate with Enabling Technology</td>
<td>8% of CP billing demand</td>
</tr>
<tr>
<td>Time of Use Rate without Enabling Technology</td>
<td>5.2% of CP billing demand</td>
</tr>
<tr>
<td>Behavior DR</td>
<td>12.9% of CP billing demand</td>
</tr>
</tbody>
</table>
## Demand Response Assumptions – Non-Residential Load Reduction

<table>
<thead>
<tr>
<th>Program</th>
<th>Non-Residential Load Reduction Per Participant</th>
</tr>
</thead>
<tbody>
<tr>
<td>DLC Central AC Switch</td>
<td>1.103 kW</td>
</tr>
<tr>
<td>DLC Central AC Thermostat</td>
<td>0.96 kW</td>
</tr>
<tr>
<td>DLC Water Heaters</td>
<td>0.6 kW Summer, 1.2 kW Winter</td>
</tr>
<tr>
<td>DLC Electric Space Heaters</td>
<td>1.5 kW</td>
</tr>
<tr>
<td>DLC Lighting</td>
<td>8.9% of CP billing demand</td>
</tr>
<tr>
<td>Curtail Agreements</td>
<td>5% of CP billing demand for day ahead, 3% day of</td>
</tr>
<tr>
<td>Demand Bidding</td>
<td>7% of CP billing demand</td>
</tr>
<tr>
<td>Capacity Bidding</td>
<td>19.5% of CP billing demand</td>
</tr>
<tr>
<td>Time of Use Rate with Enabling Technology</td>
<td>3.8% of CP billing demand</td>
</tr>
<tr>
<td>Time of Use Rate without Enabling Technology</td>
<td>2% of CP billing demand</td>
</tr>
</tbody>
</table>
### Demand Response Assumptions – Residential Costs

<table>
<thead>
<tr>
<th>Program</th>
<th>Equipment &amp; Installation Cost</th>
<th>Incentive Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>DLC Central AC One-Way Communicating Switch</td>
<td>$220</td>
<td>$20/participant/year</td>
</tr>
<tr>
<td>DLC Central AC Two-Way Communicating Switch</td>
<td>$245</td>
<td>$20/participant/year</td>
</tr>
<tr>
<td>DLC Central AC Thermostat</td>
<td>$300</td>
<td>$20/participant/year</td>
</tr>
<tr>
<td>DLC Smart Appliances</td>
<td>$245</td>
<td>$20/participant/year</td>
</tr>
<tr>
<td>DLC Water Heaters</td>
<td>$300</td>
<td>$20/participant/year</td>
</tr>
<tr>
<td>DLC Electric Space Heaters</td>
<td>$0; assumed must be participating in DLC AC program</td>
<td>$20/participant/year</td>
</tr>
<tr>
<td>DLC Electric Vehicle Chargers</td>
<td>$0; assumed must have Level 2 charger</td>
<td>$50/participant/year</td>
</tr>
<tr>
<td>Battery Energy Storage</td>
<td>$12,385</td>
<td>$0</td>
</tr>
<tr>
<td>Time of Use Rate with Enabling Technology</td>
<td>$300</td>
<td>$0</td>
</tr>
<tr>
<td>Time of Use Rate without Enabling Technology</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Behavior DR</td>
<td>$0</td>
<td>$0.75/kWh</td>
</tr>
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</table>
## Demand Response Assumptions – Non-Residential Costs

<table>
<thead>
<tr>
<th>Program</th>
<th>Equipment &amp; Installation Cost</th>
<th>Incentive Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>DLC Central AC One-Way Communicating Switch</td>
<td>$220</td>
<td>$30/participant/year</td>
</tr>
<tr>
<td>DLC Central AC Two-Way Communicating Switch</td>
<td>$245</td>
<td>$30/participant/year</td>
</tr>
<tr>
<td>DLC Central AC Thermostat</td>
<td>$300</td>
<td>$30/participant/year</td>
</tr>
<tr>
<td>DLC Water Heaters</td>
<td>$300</td>
<td>$30/participant/year</td>
</tr>
<tr>
<td>DLC Electric Space Heaters</td>
<td>$0; assumed must be participating in DLC AC program</td>
<td>$30/participant/year</td>
</tr>
<tr>
<td>DLC Lighting</td>
<td>$1,900</td>
<td></td>
</tr>
<tr>
<td>Curtail Agreements</td>
<td>$0</td>
<td>Starts at $87/kW-yr for MAP and $47/kW-yr for RAP; increases by 2% per year</td>
</tr>
<tr>
<td>Demand Bidding</td>
<td>$0</td>
<td>$0.5/kWh-yr</td>
</tr>
<tr>
<td>Capacity Bidding</td>
<td>$0</td>
<td>$8.50/kW-yr</td>
</tr>
<tr>
<td>Time of Use Rate with Enabling Technology</td>
<td>$300</td>
<td>$0</td>
</tr>
<tr>
<td>Time of Use Rate without Enabling Technology</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Ice Energy Storage Rate</td>
<td>$55,000</td>
<td>$0</td>
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</table>
## Demand Response Assumptions – Adoption Rates

### Residential Adoption Rates

<table>
<thead>
<tr>
<th>Program</th>
<th>MAP</th>
<th>RAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>DLC Central AC (Switch and Thermostat Total)</td>
<td>71%</td>
<td>41%</td>
</tr>
<tr>
<td>DLC Smart Appliances</td>
<td>31%</td>
<td>20%</td>
</tr>
<tr>
<td>DLC Water Heaters</td>
<td>65%</td>
<td>35%</td>
</tr>
<tr>
<td>DLC Electric Space Heaters</td>
<td>20%</td>
<td>15%</td>
</tr>
<tr>
<td>DLC Electric Vehicle Chargers</td>
<td>72%</td>
<td>27%</td>
</tr>
<tr>
<td>Battery Energy Storage</td>
<td>10%</td>
<td>5%</td>
</tr>
<tr>
<td>Time of Use Rate (with and without Enabling Technology total)</td>
<td>64%</td>
<td>46%</td>
</tr>
<tr>
<td>Behavior DR</td>
<td>93%</td>
<td>21%</td>
</tr>
</tbody>
</table>

### Non-Residential Adoption Rates

<table>
<thead>
<tr>
<th>Program</th>
<th>MAP</th>
<th>RAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>DLC Central AC (Switch and Thermostat Total)</td>
<td>14%</td>
<td>3%</td>
</tr>
<tr>
<td>DLC Water Heaters</td>
<td>16%</td>
<td>7%</td>
</tr>
<tr>
<td>DLC Electric Space Heaters</td>
<td>14%</td>
<td>3%</td>
</tr>
<tr>
<td>DLC Lighting</td>
<td>14%</td>
<td>3%</td>
</tr>
<tr>
<td>Demand Bidding</td>
<td>8%</td>
<td>1%</td>
</tr>
<tr>
<td>Capacity Bidding</td>
<td>21%</td>
<td>3%</td>
</tr>
<tr>
<td>Time of Use Rate (with and without Enabling Technology total)</td>
<td>74%</td>
<td>13%</td>
</tr>
<tr>
<td>Ice Energy Storage Rate</td>
<td>81%</td>
<td>16%</td>
</tr>
</tbody>
</table>
2022 Integrated Resource Plan (IRP)

Public Advisory Meeting #3
6/27/2022
Agenda and Introductions

Stewart Ramsay, Managing Executive, Vanry & Associates
<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>Speakers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Starting at 10:00 AM</td>
<td>Virtual Meeting Protocols and Safety, Schedule</td>
<td>Chad Rogers, Senior Manager, Regulatory Affairs, AES Indiana</td>
</tr>
<tr>
<td></td>
<td>IRP Midway Touchpoint</td>
<td>Kristina Lund, President &amp; CEO, AES Indiana</td>
</tr>
<tr>
<td></td>
<td>Stakeholder Presentations</td>
<td>Wendy Bredhold, Senior Campaign Representative, Sierra Club</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ray Wilson, Faith in Place</td>
</tr>
<tr>
<td></td>
<td>IRP Schedule &amp; Meeting #2 Recap</td>
<td>Erik Miller, Manager, Resource Planning, AES Indiana</td>
</tr>
<tr>
<td></td>
<td>2022 All-Source RFP &amp; Replacement Resource Cost Update</td>
<td>Erik Miller, Manager, Resource Planning, AES Indiana</td>
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<tr>
<td></td>
<td>Commodity Forecasts</td>
<td>Erik Miller, Manager, Resource Planning, AES Indiana</td>
</tr>
<tr>
<td></td>
<td>RTO Reliability Planning: Resource Adequacy &amp; Seasonal Construct</td>
<td>Lynn Hecker, Senior Manager, Resource Adequacy Policy and Analytics, MISO</td>
</tr>
<tr>
<td>Break</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12:00 PM – 12:30 PM</td>
<td>Lunch</td>
<td></td>
</tr>
<tr>
<td>Afternoon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Starting at 12:30 PM</td>
<td>Modeling Reliability Assumptions</td>
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<td>Hisham Othman, VP Transmission and Regulatory Consulting, Quanta</td>
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<td>AES Indiana Distribution System Planning</td>
<td>Kathy Storm, Vice President, US Smart Grid, AES Indiana</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mike Russ, Senior Manager, T&amp;D Forecasting, AES Indiana</td>
</tr>
<tr>
<td></td>
<td>Final Q&amp;A and Next Steps</td>
<td></td>
</tr>
</tbody>
</table>
Virtual Meeting
Protocols and Safety

Chad Rogers, Senior Manager, Regulatory Affairs, AES Indiana
AES Indiana IRP Partners
Annette Brocks, Senior Resource Planning Analyst, ACES
Patrick Burns, PV Modeling Lead and Regulatory/IRP Support, Brightline Group
Eric Fox, Director, Forecasting Solutions, Itron
Jeffrey Huber, Overall Project Manager and MPS Lead, GDS Associates
Jordan Janflone, EV Modeling Forecasting, GDS Associates
Patrick Maguire, Executive Director of Resource Planning, ACES
Hisham Othman, Vice President, Transmission and Regulatory Consulting, Quanta Technology
Stewart Ramsey, Managing Executive, Vanry & Associates
Mike Russo, Forecast Consultant, Itron
Jacob Thomas, Market Research and End-Use Analysis Lead, GDS Associates
Melissa Young, Demand Response Lead, GDS Associates

AES Indiana Legal Team
Nick Grimmer, Indiana Regulatory Counsel, AES Indiana
Teresa Morton Nyhart, Counsel, Barnes & Thornburg LLP
Welcome to Today’s Participants

IBEW Local Union 1395
Indiana Chamber
Indiana DG
Indiana Distributed Energy Alliance
Indiana Energy Association
Indiana Utility Regulatory Commission
Indiana State Conference of the NAACP
IUPUI
NIPSCO
NuScale Power
Office of Utility Consumer Counselor
Power Takeoff
Purdue - State Utility Forecasting Group
Ranger Power
Reliable Energy
Rolls-Royce/ISS
Sierra Club
Solar United Neighbors
Synapse Energy Economics
Wartsila

… and members of the AES Indiana team and the public!
Virtual Meeting Best Practices

→ Your candid feedback and input is an integral part to the IRP process.
→ Questions or feedback will be taken at the end of each section.
→ Feel free to submit a question in the chat function at any time and we will ensure those questions are addressed.

Audio

→ All lines are muted upon entry.
→ For those using audio via Teams, you can unmute by selecting the microphone icon.
→ If you are dialed in from a phone, press *6 to unmute.

Video

→ Video is not required. To minimize bandwidth, please refrain from using video unless commenting during the meeting.
AES Purpose & Values

- Safety first
- Highest standards
- All together
Our safety beliefs

1. Safety comes first for our people, our contractors and our communities.

2. All occupational incidents can be prevented.

3. Working safely is a condition of employment.

4. All AES people and contractors have the right and obligation to stop work when they identify a situation they believe to be unsafe.

We can all be safety leaders.
AES

→ Fortune 200 company with operations in 14 countries across 4 continents.
→ Track record of innovation in the technologies that are transforming the energy sector.
→ AES is a global energy company and with the addition of 5 GW of new renewables in 2021, is now positioned as the fastest growing US renewables developer and the largest supplier of corporate renewables contracts in the world.
→ AES announced a target to exit coal by year-end 2025 at the global portfolio level, subject to meeting regulatory obligations. The exit may be achieved through asset sales, fuel conversions or retirements.

AES Indiana

→ 20-year IRP plan created with stakeholder input.
→ Modeling and analysis culminates in a preferred resource portfolio and a short-term action plan.
→ The need for a utility to engage in a rigorous stakeholder process and describe how the utility plans to deliver safe, reliable and efficient electricity at just and reasonable rates is a legal requirement in Indiana and is an obligation AES Indiana will meet.
Leading the inclusive, clean energy transition

1. AES Indiana has a diverse power generation portfolio that serves our customers’ needs today and well into the future.

2. Our 2019 IRP projected that AES Indiana would achieve a reduction in carbon intensity of more than 40% from 2015 to 2025.

3. AES Indiana has been incorporating new technologies and fuels into its generation fleet for more than a decade.
   - Signed power purchase agreements with wind farms back beginning in 2009
   - Converted Harding Street from coal to natural gas
   - Retired Eagle Valley coal and started operations of a new CCGT in 2018
   - Announced plans to retire Petersburg Unit 1 in 2021 and Unit 2 in 2023 and signed the acquisitions of Hardy Hills (195 MW solar project) and the Petersburg Energy Center (250 MW solar and 180 MWh energy storage project)

4. AES Indiana is committed to safety and compliance of all environmental regulations and will responsibly close ash ponds in the manner required by Indiana state law.
Stakeholder Presentations
Stakeholder Presentations
IRP Schedule & Meeting #2 Recap
Updated 2022 IRP Timeline

IRP Kickoff

Public Advisory Meeting #1
January 24, 2022

Public Advisory Meeting #2
April 12, 2022

Public Advisory Meeting #3
June 27, 2022

Public Advisory Meeting #4
August 2022

Public Advisory Meeting #5
October 2022

File IRP
Nov. 1, 2022

2022

Market Potential Study – Includes biweekly stakeholder meetings
Load Forecast
Distribution System Planning
Other Inputs & Assumptions

Core IRP Modeling

Portfolio Evaluation & Risk
Report Narrative

Issue Generation RFP - Date TBD in 2022

AES Indiana is available for additional touchpoints with stakeholders to discuss IRP-related topics.
Public Advisory Schedule

**Public Advisory Meeting #1 – January 24, 2022**
- 2022 IRP Schedule & Progress
- 2019 IRP Recap
- Load, EV, DG Forecasts
- MPS Overview

**Public Advisory Meeting #2 – April 12, 2022**
- Load Scenarios
- MPS Results & DSM Inputs
- Replacement Resource Assumptions
- IRP Portfolio Matrix & Scenario Framework

**Public Advisory Meeting #3- June 27, 2022**
- Stakeholder Presentations
- Portfolio Metrics & Scorecard Framework
- MISO Reliability Planning
- IRP Reliability Analysis
- Distribution System Plan

**Public Advisory Meeting #4 - August**
- Preliminary Modeling Results
- Risk Analysis
- Preliminary Scorecard Results

**Public Advisory Meeting #5 - October**
- 2022 Modeling Insights
- Preferred Resource Portfolio & Short-Term Action Plan
IRP Process Overview

**DSM Market Potential Study (MPS)**
- End Use Analysis
- Comprehensive measure list
- Measure uptake & potentials: MAP & RAP
- Develop IRP model inputs (bundles)

**Replacement Resource Costs**
- Cost assumptions from 2020 RFP and Consultants, e.g., Wood Mackenzie, NREL
- New RFP issued date TBD in 2022

**Distribution System Planning (DSP)**
- Bottom-up forecast on sample of constrained circuits
- Assess EV and DG impacts
- Load shapes inform IRP analysis

**Load Forecast**
- Itron SAE Methodology
- Base, High & Low Scenarios
- IRP model peak and energy inputs

---

**Core IRP Modeling & Evaluation**

**Capacity Expansion Modeling**
- Retirement and replacement analysis
- Portfolio optimization

**Production Cost Modeling & PVRR**
- Prod Cost - Portfolio dispatch analysis serve as PVRR inputs
- Portfolio PVRR analysis
- Stochastic risk analysis

**Portfolio Evaluation & Short-Term Action Plan**
- Screen against Evaluation Criteria
- Selection of Preferred Resource Portfolio & Short-Term Action Plan

**IRP Submitted Nov. 1, 2022**

**IRP-driven Filings**
- DSM Filing
- Certificate of Public Convenience and Necessity (CPCN) Filing

---

**Other Inputs & Assumptions**
- Portfolio and scenario framework
- Power & Commodity Price Forecasts
- Model Parameters & Constraints
- Existing Resources
Combining Strategies and Scenarios results in the Portfolio Matrix or framework for IRP evaluation:

<table>
<thead>
<tr>
<th>Generation Strategies</th>
<th>No Environmental Action</th>
<th>Current Trends (Reference Case)</th>
<th>Aggressive Environmental</th>
<th>Decarbonized Economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Early Retirement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pete Refuel to 100% Gas (est. 2025)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One Pete Unit Retires (2026)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Both Pete Units Retire (2026 &amp; 2028)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Clean Energy Strategy&quot;  Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Encompass Optimization without predefined Strategy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Portfolio cost (PVRR) will be calculated for each portfolio to complete Portfolio Matrix.

- The Current Trends portfolios defined above will be evaluated using a Scorecard that includes cost, environmental, reliability & risk metrics.
- A Preferred Resource Portfolio will be selected using this rigorous Scorecard evaluation process.
Other Updates from Meeting #2

1) Energy Efficiency Bundles

After stakeholder collaboration AES Indiana decided to split Efficient Products and Residential Vintage 2 & 3 into higher and lower cost bundles to provide the opportunity for additional cost-effective energy efficiency to get selected.

<table>
<thead>
<tr>
<th>BEFORE</th>
<th>AFTER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Residential</strong></td>
<td><strong>Residential</strong></td>
</tr>
<tr>
<td>Vintage 1 2024 - 2026</td>
<td>Vintage 1 2024 - 2026</td>
</tr>
<tr>
<td>Efficient Products</td>
<td>Efficient Products - Lower Cost</td>
</tr>
<tr>
<td>Behavioral</td>
<td>Behavioral</td>
</tr>
<tr>
<td>School Education</td>
<td>School Education</td>
</tr>
<tr>
<td>Appliance Recycling</td>
<td>Appliance Recycling</td>
</tr>
<tr>
<td>Multifamily</td>
<td>Multifamily</td>
</tr>
<tr>
<td>*IQW</td>
<td>*IQW</td>
</tr>
<tr>
<td><strong>C&amp;I</strong></td>
<td><strong>C&amp;I</strong></td>
</tr>
<tr>
<td>Prescriptive</td>
<td>Prescriptive</td>
</tr>
<tr>
<td>Custom</td>
<td>Custom</td>
</tr>
<tr>
<td>Custom RCx</td>
<td>Custom RCx</td>
</tr>
<tr>
<td>Custom SEM</td>
<td>Custom SEM</td>
</tr>
<tr>
<td>All Residential (excluding IQW)</td>
<td>All Residential (excluding IQW)</td>
</tr>
<tr>
<td>All C&amp;I</td>
<td>All C&amp;I</td>
</tr>
<tr>
<td>*IQW Program will be predefined in the IRP modeling</td>
<td>*IQW Program will be predefined in the IRP modeling</td>
</tr>
</tbody>
</table>
2022 All-Source RFP & Replacement Resource Costs Update
2022 All-Source Generation RFP
Summary of All-Source RFP Responses

<table>
<thead>
<tr>
<th>Technology</th>
<th># of Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar</td>
<td>14</td>
</tr>
<tr>
<td>Wind</td>
<td></td>
</tr>
<tr>
<td>Thermal-Aero CT</td>
<td></td>
</tr>
<tr>
<td>Solar + Storage</td>
<td></td>
</tr>
<tr>
<td>Storage</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>24</strong></td>
</tr>
</tbody>
</table>

A project is defined as a unique site and each site may have multiple proposal offerings (PPA, Asset Transfer, etc.).
All-Source RFP Capacity Summary

- Low volume of wind capacity possibly due to limited siting availability in Indiana and uncertainty around PTC
- Capacity volumes help to inform resource build constraints included in the IRP planning model (EnCompass)
Commodity Forecasts
In response to stakeholder comment and in order to ensure reasonable forecasts are included in this IRP – AES Indiana has had Horizon Energy update the custom fundamental power price studies using the Spring gas and coal price outlook. Thus, this IRP reflects the recent upward trend in gas, coal and power prices. The following commodity review slides reflect this update.
## Summary of Scenario Commodity Assumptions

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Gas</th>
<th>Coal</th>
<th>Power</th>
<th>Capacity</th>
<th>NOx</th>
<th>CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Environmental Action – “No Env”</td>
<td>Low</td>
<td>Base</td>
<td>Custom</td>
<td>Base</td>
<td>Base</td>
<td>None</td>
</tr>
<tr>
<td>Current Trends (Reference Case) – “Ref”</td>
<td>Base</td>
<td>Base</td>
<td>Custom</td>
<td>Base</td>
<td>Base</td>
<td>Base</td>
</tr>
<tr>
<td>Aggressive Environmental – “AE”</td>
<td>High</td>
<td>Base</td>
<td>Custom</td>
<td>Base</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Decarbonized Economy – “Decarb”</td>
<td>Base</td>
<td>Base</td>
<td>Custom</td>
<td>Base</td>
<td>High</td>
<td>None – Clean Energy Mandate</td>
</tr>
</tbody>
</table>
Methodology: Blending Curves

Power prices, gas prices and coal prices are a blend of forward market curves and Fundamental Curves from Horizon Energy.

Blending prices in near-term captures near-term market impacts.
Fuel Price Forecasts

→ Blended Long-term Coal Prices –
  → 2023 – 2025 Blended: Internal Mkt Intelligence,
  → 2026 – 2042: Internal Mkt Intelligence with Horizon Energy
  Spring Case growth rate for Illinois Basin

Long-Term Gas Prices

Long-term Coal Prices – All Scenarios
Power Price Forecast

On-Peak Power

Off-Peak Power
Capacity Price Forecast

Capacity Price – All Scenarios
Near Term Projections are Confidential
RTO Reliability Planning: Resource Adequacy & Seasonal Construct

Lynn Hecker, Senior Manager, Resource Adequacy Policy and Analytics, MISO
## Break for Lunch

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>Speakers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afternoon Starting at 12:30 PM</td>
<td>Modeling Reliability Assumptions</td>
<td>Erik Miller, Manager, Resource Planning, AES Indiana</td>
</tr>
<tr>
<td></td>
<td>Reliability Analysis &amp; Reliability Metric</td>
<td>Hisham Othman, VP Transmission and Regulatory Consulting, Quanta</td>
</tr>
<tr>
<td></td>
<td>Portfolio Metrics &amp; Scorecard</td>
<td>Erik Miller, Manager, Resource Planning, AES Indiana</td>
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<td>AES Indiana Distribution System Planning</td>
<td>Kathy Storm, Vice President, US Smart Grid, AES Indiana, Mike Russ, Senior Manager, T&amp;D Forecasting, AES Indiana</td>
</tr>
<tr>
<td></td>
<td>Final Q&amp;A and Next Steps</td>
<td></td>
</tr>
</tbody>
</table>
Modeling Reliability Assumptions

Erik Miller, Manager, Resource Planning, AES Indiana
Reliability Overview
The Importance of Measuring Reliability

Guiding research on reliability

MISO’s Renewable Integration Impact Assessment (RIIA) – completed Feb 2021

- MISO analysis to understand the bulk electric system needs and risks as intermittent renewable resources increasingly replace baseload resources.
- Analysis finds increasing risk and need for coordinated action as renewables increase to 30% and 50% of the MISO system portfolio.

RIIA’s three key areas of focus

- The RIIA analysis suggests three key focus areas for MISO and stakeholders.
- Utilities can consider two of the three within the context of the IRP.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Definition</th>
<th>Planning Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource Adequacy</td>
<td>Having sufficient resources to reliably serve peak demand</td>
<td>AES Indiana will address in this IRP</td>
</tr>
<tr>
<td>Energy Adequacy</td>
<td>Ability to provide energy in all operating hours continuously throughout the year</td>
<td>AES Indiana will address in this IRP</td>
</tr>
<tr>
<td>Operating Reliability</td>
<td>Ability to withstand unanticipated component losses or disturbances</td>
<td>Joint coordination between AES Indiana and MISO</td>
</tr>
</tbody>
</table>

Reliability in the IRP

MISO Seasonal Resource Adequacy Construct

→ On November 30, 2021 – MISO filed with FERC to include seasonal and accreditation requirements for the MISO Resource Adequacy Construct.

→ Reason: Ensure resource adequacy across all seasons after significant increase in MaxGen events resulting from the retirement of baseload generation, increased intermittent resources and extreme weather events.

→ MISO’s proposed filing would require MISO member utilities to meet an unforced capacity requirement in each season as opposed to only Summer (current requirement).

→ MISO has proposed these changes begin in the 2023/2024 planning year.

Planning Implications

→ AES Indiana will model a four-season Resource Adequacy Construct starting in 2023/2024 to align with MISO’s FERC filing.

→ Per MISO guidance, AES Indiana will include these reserve margin targets in the IRP analysis:

<table>
<thead>
<tr>
<th>Season</th>
<th>PRM%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer</td>
<td>7.51%</td>
</tr>
<tr>
<td>Fall</td>
<td>11.82%</td>
</tr>
<tr>
<td>Winter</td>
<td>21.35%</td>
</tr>
<tr>
<td>Spring</td>
<td>26.27%</td>
</tr>
</tbody>
</table>

Target Seasonal Planning Reserve Margin:
Reliability in the IRP

Resource Adequacy: Having sufficient resources to reliably serve load

Planning Implications:

- The planning model will capture the changing availability of wind and solar through the ELCC, i.e. capacity value for wind and solar
- AES Indiana has consulted with MISO to understand the ELCC value for seasonal planning – Summer, Winter, Spring & Fall

*Charts from MISO RIIA Report pp.27 & 29

**AES Indiana presented ELCC of wind, solar and storage resources in Public Stakeholder Meeting #2 – also provided in slide appendix of this deck**
Production Cost Modeling (8,760)

→ As part of the core IRP modeling, AES Indiana will perform a production cost analysis on each candidate portfolio.

→ The analysis provides an understanding of economic energy adequacy or how much AES Indiana will rely on the market for sales and purchases.

System Reliability Analysis

→ AES Indiana contracted Quanta Energy to perform a System Reliability Analysis as part of the IRP Scorecard evaluation.

→ The analysis looks at eight system metrics with the objective of evaluating how well the candidate portfolios deliver sufficient energy and system stability in every hour.

→ Quanta Energy will review the methodology for the System Reliability Analysis in the slides that follow.
Reliability Analysis

Hisham Othman, VP Transmission and Regulatory Consulting, Quanta
Power systems rely on several reliability services to operate and deliver expected services. Some have traditionally been assumed to be provided by the supply resources, while others are procured by the market. As the resource portfolio changes, the associated essential reliability services should be assessed and secured.

NERC (2022 Summer Reliability Assessment – MISO):

→ Midcontinent ISO (MISO) faces a capacity shortfall in its North and Central areas, resulting in high risk of energy emergencies during peak summer conditions.

→ More extreme temperatures, higher generation outages, or low wind conditions expose the MISO North and Central areas to higher risk of temporary operator-initiated load shedding to maintain system reliability.

PJM (Grid of the Future - May 2022):

→ A proliferation of IBRs can significantly impact reactive control, stability, short-circuit current, inertia and frequency control – all critical dimensions of future grid planning.
Resource Reliability Attributes

→ Reliability and Resilience Attributes/Metrics:
  → Dispatchability
  → Predictability
  → Dependability (e.g., Supply Resilience, firmness)
  → Performance Duration Limits
  → Flexibility (e.g., ramping speed, operating range)
  → Intermittency (e.g., intra-hour and multi-hour ramping)
  → Dynamic VAR support
  → Energy Profile (e.g., capacity value / ELCC)
  → Inertial Response
  → Primary Frequency Response
  → Minimum Short Circuit Ratio
  → Locational Characteristics (e.g., deliverability, resilience to grid outages)
  → Blackstart and system restoration support
  → Harmonics
Assuring System Reliability – Traditional Approach

- Resource Adequacy
- Reliable System
- Transmission Security
- Production Cost Simulations
Assuring System Reliability – Evolving Approaches
Reliability Assessment & Portfolio Eval. Methodology

**Review & Update Reliability Metrics**

**Assemble Data and Configure Analysis Tools**
- Existing Resources
- IRP Portfolios
- Grid Models
- Solar & Wind Profiles
- Load Profile
- Transfer Capability with Outside

**Apply a Series of Reliability Filters to IRP Portfolios**

**Design Scoring Criteria**

**Evaluate Portfolios**
## Indicative Scope of Reliability Studies

<table>
<thead>
<tr>
<th>Reliability Study Area</th>
<th>Normal (50/50, Connected)</th>
<th>Max-Gen (90/10, Import Limited)</th>
<th>Islanded (Critical Load)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Resource Adequacy</td>
<td>X (also 90/10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Energy Adequacy</td>
<td>X (8760)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Transmission Reliability / Deliverability / Interconnections</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Energy Adequacy</th>
<th>X</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Operational Flexibility and Frequency Support</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3</td>
<td>Short Circuit Strength Requirement</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4</td>
<td>Power Quality (Flicker)</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Blackstart</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>6</td>
<td>Dynamic VAR Deliverability</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Dispatchability and Automatic Generation Control</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Predictability and Firmness of Supply</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Geographic Location Relative to Load</td>
<td>X</td>
<td></td>
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</tbody>
</table>

→ Additional Reliability Analysis
# Reliability Metrics (1/2)

<table>
<thead>
<tr>
<th>Metric</th>
<th>Description</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Energy Adequacy</td>
<td>Resources are able to meet the energy and capacity duration requirements. Portfolio resources are able to supply the energy demand of customers during normal and emergency max gen events, and also to supply the energy needs of critical loads during islanded operation events.</td>
<td>Utility must have long duration resources to serve the needs of its customers during emergency and islanded operation events.</td>
</tr>
<tr>
<td>2. Operational Flexibility and Frequency Support</td>
<td>Ability to provide inertial energy reservoir or a sink to stabilize the system. Additionally, resources can adjust their output to provide frequency support or stabilization in response to frequency deviations with a droop of 5% or better.</td>
<td>Regional markets and/or control centers balance supply and demand under different time frames according to prevailing market construct under normal conditions, but preferable that local control centers possess the ability to maintain operation during under-frequency conditions in emergencies.</td>
</tr>
<tr>
<td>3. Short Circuit Strength Requirement</td>
<td>Ensure the strength of the system to enable the stable integration of all inverter-based resources (IBRs) within a portfolio.</td>
<td>The retirement of synchronous generators within utility footprint and replacements with increasing levels of inverter-based resources will lower the short circuit strength of the system. Resources that can operate at lower levels of short circuit ratio (SCR) and those that provide higher short circuit current provide a better future proofing without the need for expensive mitigation measures.</td>
</tr>
<tr>
<td>4. Power Quality (Flicker)</td>
<td>The “stiffness of the grid” affect the sensitivity of grid voltages to the intermittency of renewable resources. Ensuring the grid can deliver power quality in accordance with IEEE standards is essential.</td>
<td>Retirement of large thermal generation plants lower the strength of the grid and increases its susceptibility to voltage flicker due to intermittency of renewable resources, unless properly assessed and mitigated.</td>
</tr>
<tr>
<td>5. Blackstart</td>
<td>Ensure that resources have the ability to be started without support from the wider system or are designed to remain energized without connection to the remainder of the system, with the ability to energize a bus, supply real and reactive power, frequency and voltage control</td>
<td>In the event of a black out condition, utility must have a blackstart plan to restore its local electric system. The plan should demonstrate the ability to energize a cranking path to start large flexible resources with sufficient energy reservoir.</td>
</tr>
<tr>
<td>6. Dynamic VAR Support</td>
<td>Customer equipment driven by induction motors (e.g., air conditioning or factories) requires dynamic reactive power after a grid fault to avoid stalling. The ability of portfolio resources to provide this service depends on their closeness to the load centers.</td>
<td>Utility must retain resources electrically close to load centers to provide this attribute in accordance with NERC and IEEE Standards</td>
</tr>
</tbody>
</table>
## Reliability Metrics (2/2)

<table>
<thead>
<tr>
<th>Metric</th>
<th>Description</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 Dispatchability and Automatic Generation</td>
<td>Resources should respond to directives from system operators regarding their status, output, and timing. Resources that can be ramped up and down automatically to respond immediately to changes in the system contribute more to reliability than resources which can be ramped only up or only down, and those in turn are better than ones that cannot be ramped.</td>
<td>Ability to control frequency is paramount to stability of the electric system and the quality of power delivered to customers. Control centers (regional or local) provide dispatch signals under normal conditions, and under emergency restoration procedures or other operational considerations.</td>
</tr>
<tr>
<td>Automatic Control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Predictability and Firmness of Supply</td>
<td>Ability to predict/forecast the output of resources and to counteract forecast errors.</td>
<td>The ability to predict resource output from a day-ahead to real-time is advantageous to minimize the need for spinning reserves. In places with an active energy market, energy is scheduled with the market in the day-ahead hourly market and in the real-time 5-minute market. Deviations from these schedules have financial consequences and thus the ability to accurately forecast the output of a resource up to 38 hours ahead of time for the day-ahead market and 30 minutes for the real time market is advantageous.</td>
</tr>
</tbody>
</table>
| 9 Geographic Location                       | Ensure the ability to have redundant power evacuation or deliverability paths from resources. Preferrable to locate resources at substations with easy access to multiple high voltage paths, unrestricted fuel supply infrastructure, and close to major load centers. | Location provides economic value in the form of reduced losses, congestion, curtailment risk, and address local capacity requirements. Additionally, from a reliability perspective, resources that are interconnected to buses with multiple power evacuation paths and those close to load centers are more resilient to transmission system outages and provide better assistance in the blackstart restoration process. | Relative to Load (Resilience)

(Resilience)
Sample Analysis

The following are illustrative sample analyses, not related to AES-Indiana system or portfolios.
(1) Energy Adequacy during Market Emergency Events

**Illustrative sample analyses, not related to AES-Indiana system or portfolios**

The analysis shows that a sample Portfolio P1 is energy long and relies on energy purchases only 136 hours in a year (i.e., 2% of time) to meet its energy needs with a maximum purchase of 475MW, while it has excess energy to potentially sell 6,658 hours in a year (i.e., 76% of time).
(1) Energy Adequacy – Scenario & Stochastic Study Approaches

**Illustrative sample analyses, not related to AES-Indiana system or portfolios**
Impact:

→ When conventional power plants with synchronous generators are retired and/or the system tie-lines are severed, the short circuit currents will dramatically decline. IBRs are not a substitute because their short circuit contribution is limited, and also the phase of their current (real) is not aligned with typical short circuit currents (reactive).

→ Declining SCMVA and increasing IBRs will eventually violate the ESCR limits, requiring either a prohibition on additional IBR interconnections, or provisioning additional mitigation measures.

→ Mitigations can come in the form of optimal placement of IBRs to avoid clustering them in a manner that violates the ESCR limits, provisioning synchronous condensers, or requiring inverters to have grid-forming (GFM) capability.
(3) Short Circuit Strength: Equivalent Short Circuit Ratio

**Illustrative sample analyses, not related to AES-Indiana system or portfolios**

Optimal Placement of IBRs* from Short Circuit perspective to avoid ESCR limitation:

\[
\text{MAXIMIZE } \sum_{j \in \text{buses}} P_j \\
\text{Subject to } \sum_j IF_{ji} \cdot P_j \leq \frac{S_i}{ESCR\ \text{Threshold}} \\
P_j \geq 0
\]

<table>
<thead>
<tr>
<th>Bus #</th>
<th>IBR* (MW)</th>
<th>SCMVA</th>
<th>SCR</th>
<th>ESCR</th>
<th>ESCR with SC</th>
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<tr>
<td>237</td>
<td>30</td>
<td>343</td>
<td>11.5</td>
<td>2.1</td>
<td>3.2</td>
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<tr>
<td>59200</td>
<td>32</td>
<td>369</td>
<td>11.5</td>
<td>2.3</td>
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<td>600</td>
<td>18.7</td>
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<td>4.0</td>
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<td>311</td>
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<td>548</td>
<td>19.8</td>
<td>3.0</td>
<td>4.9</td>
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</tbody>
</table>

SCR is not a good indicator under high IBR penetration
Synchronous Condensers (SC) can increase short circuit strength

*Inverter Based Resource (IBR)
(5) Black Start Studies – Key Considerations

**Illustrative sample analyses, not related to AES-Indiana system or portfolios**

→ **Results:**
  - Inverter Size (MVA, PF)
  - BESS Size (MW, MWh)
  - BESS control and protection settings
  - Transformer tap settings
  - Protection setting adjustments
(8) Resource Predictability & Firmness: Variability Analysis

**Illustrative sample analyses, not related to AES-Indiana system or portfolios**

<table>
<thead>
<tr>
<th>Forecast Error%</th>
<th>Solar</th>
<th>Wind</th>
<th>S+S</th>
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</thead>
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<tr>
<td>Standard Deviation</td>
<td>9.9%</td>
<td>7.5%</td>
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<td>min Error</td>
<td>-39%</td>
<td>-42%</td>
<td>-33%</td>
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<tr>
<td>max Error</td>
<td>39%</td>
<td>48%</td>
<td>33%</td>
</tr>
<tr>
<td>90% Percentile</td>
<td>19%</td>
<td>8%</td>
<td>12%</td>
</tr>
</tbody>
</table>
(8) Resource Predictability & Firmness: Net Load Power Ramps

**Illustrative sample analyses, not related to AES-Indiana system or portfolios**

- Highest Up/Down Ramp Days
- Highest Up/Down Ramp Rate Hours

→ Significant change in Net Load profile from a conventional shape in 2020 to a “Duck Curve” in 2030
## (8) Resource Predictability & Firmness: Net Load Power Ramps

**Illustrative sample analyses, not related to AES-Indiana system or portfolios**

<table>
<thead>
<tr>
<th>Year</th>
<th>Ramp UP</th>
<th>Ramp DN</th>
<th>Ramp Rate UP</th>
<th>Ramp Rate DN</th>
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<td>-1,255</td>
<td>468</td>
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<td>2031</td>
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<td>1,489</td>
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### Ramping Category

<table>
<thead>
<tr>
<th>Ramping Category</th>
<th>2020 MW %Peak</th>
<th>2030 MW %Peak</th>
<th>Increased MW 2030 vs. 2020</th>
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<tbody>
<tr>
<td>1-hr Up</td>
<td>306</td>
<td>468</td>
<td>162</td>
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<tr>
<td>1-hr Down</td>
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<td>Day Up</td>
<td>1,044</td>
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<tr>
<td>Day Down</td>
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</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Max Daily Power Ramps (MW)</th>
<th>Ramp Up</th>
<th>Ramp DN</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021</td>
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</tr>
<tr>
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<tr>
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<td>0</td>
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</tr>
<tr>
<td>2025</td>
<td>0</td>
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<td>0</td>
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<td>2032</td>
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</tr>
<tr>
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<td>0</td>
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<tr>
<td>2036</td>
<td>0</td>
<td>3,000</td>
<td>-1,500</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Max Daily Power Ramp Rates (MW/hr)</th>
<th>Ramp Up</th>
<th>Ramp DN</th>
</tr>
</thead>
<tbody>
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</tr>
<tr>
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<td>0</td>
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<td>2036</td>
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<td>600</td>
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</tbody>
</table>
(8) Resource Predictability & Firmness: Net Load Power Ramps (Y2030 vs Y2020)

**Illustrative sample analyses, not related to AES-Indiana system or portfolios**

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>Solar</th>
<th>BTM Solar</th>
<th>Wind</th>
<th>Solar + Storage</th>
<th>Day Ramping Up (MW)</th>
<th>Day Ramping Down (MW)</th>
<th>1hr Ramping Up (MW)</th>
<th>1hr Ramping Down (MW)</th>
<th>Peaker/Storage (MW)</th>
<th>Forecast Error 90th Percentile</th>
<th>Excess Ramping Capability (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>22</td>
<td>270</td>
<td>103</td>
<td>87</td>
<td>1,013</td>
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<td>103</td>
<td>224</td>
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<td>Reliability Study Area</td>
<td>Normal (50/50, Connected)</td>
<td>Max-Gen (90/10, Import Limited)</td>
<td>Islanded (Critical Load)</td>
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<td>1   Energy Adequacy</td>
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<td>2   Operational Flexibility and Frequency Support</td>
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<td>3   Short Circuit Strength Requirement</td>
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<td>4   Power Quality (Flicker)</td>
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<td>5   Blackstart</td>
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<td>6   Dynamic VAR Deliverability</td>
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<td>7   Dispatchability and Automatic Generation Control</td>
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<td>8   Predictability and Firmness of Supply</td>
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<td>9   Geographic Location Relative to Load</td>
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</table>

Scoring Criteria

Evaluate Portfolios

Portfolio Score
Portfolio Metrics & Scorecard

Erik Miller, Manager, Resource Planning, AES Indiana
Guidance for the IRP Scorecard Framework
Categorical Framework for AES Indiana’s IRP Scorecard

Each category has one or more metrics that quantitively measure portfolio performance.
Calculations for each scoring metric will be included to complete the Scorecard

---

**Strategies**

1. No Early Retirement
2. Pete Refuel to 100% Natural Gas (est. 2025)
3. One Pete Unit Retires in 2026
4. Both Pete Units Retire in 2026 & 2028
5. “Clean Energy Strategy” – Both Pete Units Retire and replaced with Renewables in 2026 & 2028
6. Encompass Optimization without Predefined Strategy

A Preferred Resource Portfolio will be selected after evaluation of the Scorecard results
Affordability Metric

PVRR = Operating Expenses → Energy Purchases → Fuel → Variable O&M → Fixed O&M → Emissions + Recovery of and Return on New Capital → Book Depreciation → Return on Rate Base → Property Taxes - Market Revenues → MISO Energy Revenue → Net Capacity Revenue
Environmental Sustainability Metrics
Reliability, Resilience and Stability Metric
## Risk & Opportunity Metrics

For each strategy, the analysis will capture:

- Risk potential using the **highest scenario PVRR** for each strategy
- Opportunity potential using the **lowest scenario PVRR** for each strategy

### Generation Strategies

<table>
<thead>
<tr>
<th>Generation Strategies</th>
<th>Current Trends - Reference Case</th>
<th>No Environmental Action</th>
<th>Aggressive Environmental</th>
<th>Decarbonized Economy</th>
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<tr>
<td>No Early Retirement</td>
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<tr>
<td>Pete Refuel to 100% Gas (est. 2025)</td>
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<tr>
<td>One Pete Unit Retires (2026)</td>
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<tr>
<td>Both Pete Units Retire (2026 &amp; 2028)</td>
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<tr>
<td>Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
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</tbody>
</table>
Risk & Opportunity Metrics

![Risk & Opportunity Metrics Diagram]
Market Exposure Metric

To estimate the risk for each strategy, AES Indiana will calculate the average of the absolute value of the annual sales and purchases and sum those over the 20-yr period.

Illustrative of AES IN gen mix to serve load
Economic Impact Metrics
# IRP Scorecard for Portfolio Evaluation

<table>
<thead>
<tr>
<th>Affordability</th>
<th>Environmental Sustainability</th>
<th>Reliability, Stability &amp; Resiliency</th>
<th>Risk &amp; Opportunity</th>
<th>Economic Impact</th>
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<tbody>
<tr>
<td>20-yr PVRR</td>
<td>CO₂ Emissions</td>
<td>Reliability Score</td>
<td>Environment Score</td>
<td>Employees (+/-)</td>
</tr>
<tr>
<td>Present Value of Revenue Requirements</td>
<td>SO₂ Emissions</td>
<td>Environment Score</td>
<td>Environment Score</td>
<td>Property Taxes</td>
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<td></td>
<td>NOₓ Emissions</td>
<td>Lowest PVRR across policy scenarios</td>
<td>Lowest PVRR across policy scenarios</td>
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<tr>
<td></td>
<td>Other Emissions</td>
<td>Highest PVRR across policy scenarios</td>
<td>Highest PVRR across policy scenarios</td>
<td></td>
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<tr>
<td></td>
<td>Water Use &amp; Coal Ash</td>
<td>Composite score from Reliability Analysis</td>
<td>Composite score from Reliability Analysis</td>
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<td></td>
<td></td>
<td>Mean - P5</td>
<td>P95 - Mean</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>20-year avg sales + purchases</td>
<td>20-year avg sales + purchases</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Total # of AES IN generation</td>
<td>Total # of AES IN generation</td>
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<td></td>
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<td>employees</td>
<td>employees</td>
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<td>Total amount of property tax paid</td>
<td>Total amount of property tax paid</td>
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<tr>
<td></td>
<td></td>
<td>from AES IN assets</td>
<td>from AES IN assets</td>
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</tr>
</tbody>
</table>

Calculations for each scoring metric will be included to complete the Scorecard.

→ **Strategies**
   → 1. No Early Retirement
   → 2. Pete Refuel to 100% Natural Gas (est. 2025)
   → 3. One Pete Unit Retires in 2026
   → 4. Both Pete Units Retire in 2026 & 2028
   → 5. “Clean Energy Strategy” – Both Pete Units Retire and replaced with Renewables in 2026 & 2028
   → 6. Encompass Optimization without Predefined Strategy

A Preferred Resource Portfolio will be selected after evaluation of the Scorecard results.
AES Indiana Distribution
System Planning
Agenda
Building the AES of the Future

Transforming the traditional one-way grid into...

An interactive two-way intelligent platform

AES Indiana
Smart Grid Vision

Engage with our customers through a more personalized experience and build a trusted customer relationship.

Build a distribution system that attracts new customers through innovative clean energy products and services.

Transform to a customer-focused, data-driven culture that empowers our people to reimaging the energy ecosystem and be leaders in the clean energy transition.

Transform our energy system and services to improve resiliency and seamlessly integrate renewables, distributed generation, energy storage and electrification technologies.
Operations Future State Vision

Distribution Network Operating Model
- Network Model
- Topology Processing
- Graphical User Interface
- DER Modeling
- DER Aggregation

Real-Time/DER Communication
- Dispatchable Generators
- Substation Devices
- Feeder Devices
- EVs and Charging Stations
- Wind
- DR and Smart Appliance
- Energy Storage
- Solar PV
- Microgrids

Operations Technology Platform
- SCADA, Alarming, Trending, Visualization, Historian, Load Shed, Study Mode

Mobile Application
- Real Time Map View
- Job Management
- Damage Assessment
- Field Switching
- Off-Line Operation
- GPS Integration

DMS – Distribution Management System
OMS – Outage Management System
DERMS – Distributed Energy Resources Management System
AMI – Advance Metering Infrastructure
Connecting Planning & Operations

- Collecting all technical data at the front of the interconnection process and translating it directly to standardized forecasting and modeling tools in planning & operations.
- Leveraging Smart Grid investments for better forecasting and model inputs.
- Devices are utilized for better operational visibility & orchestration leading to better customer outcomes.

**Smart Grid Devices**
AMI, Smart Reclosers, Sensors, SCADA/Pi, Weather data utilized to build better models and provide an operations technology platform that enhances planning and operations.
Aligned Planning at AES Indiana

- T&D Power Systems Analysis
- T&D Power System Modeling
- T&D Demand Forecasting
- Resource Planning

TOP-DOWN

BOTTOM-UP

T&D Asset Management Team  Resource Planning Team
T&D Demand Forecasting Future State Process

**Smart Grid Device Inputs**
- **Asset Data**
  - FLOC
  - SCADA/PI
  - AMI
  - DER Data
  - GIS
  - Co-op/Muni Data
  - Block Load

**Demand Forecasting**
- **Load Analysis**
  - SCADA Scrubber
  - AMI Pipeline
  - Load Normalization
  - Model 30
  - Weather Years
  - Hourly Load Profiles

- **Resource Planning**
  - Utility Internal Projections as Constraints
    - (top-down)

- **Spatial Analysis**
  - Geo-referenced
  - Econometrics
  - Demographics
  - Transportation
  - Probability of Load Growth and DER Penetration
    - (bottom-up)

- **Multi-Scenario Development**
  - Short, Mid, Long-Term Scenarios
  - Low, Medium, High Growth Rates
  - DER/EV Sensitivities
  - Weather Sensitivities

**System Modeling & Analysis Output**
- **Power Flow Models**
  - CYME
  - PSSE
  - Export to GIS for Visualization
  - Aligned Study Models for T&D in Indiana + Ohio
Load Flow Analysis for Distribution Systems

- AES uses CYME for distribution system modeling and analysis.
- CYME takes advanced forecasts/scenarios from our demand forecasting tool (LoadSEER) to develop power flow models of the system.
  - These forecasts and scenarios will be analyzed to forecast future system capacity, redundancy, and voltage needs.
  - Contingency & Scenario Planning present new challenges for distribution since multiple circuit configurations are possible with smart grid devices.
- Time series for load profiles.
  - Will become more important over time with changing load profiles due to DER, EV charging, etc. being major load modifiers.
- Advanced Capabilities Under Development:
  - Reliability Assessment
  - Recloser Placement Module
  - Time Series
  - Hosting Capacity
Example of a Battery Energy Storage System (BESS) (a Non-Wire Alternative)

Form a Microgrid when the highlighted isolation device trips

Substation

Proposed BESS

Number of Historical Trips
(1 Triangular = 1 Trip)
Distributed Energy Resources

Targeted solar to solve thermal issue, part of planning toolbox
Electric Vehicles

Distribution planning considerations for electric vehicles (ev's)

- Level 1 and 2 charging are generally manageable for capacity planning assuming effective time of use (TOU) charging rates are in place.
- Level 3 charging is more problematic due to the peak load occurring simultaneously with the grid peak and at much higher magnitudes.
- Fleet charging requests have been limited but we see the potential for very large loads in this space that may have a major impact on system planning.

Demand forecasting & network modeling

- AES will account for EV growth by taking the resource planning top-down forecast and utilizing our demand forecasting parcel level EV propensity model to allocate it down to the circuits and feeders.
- AES will study the multiple scenarios developed around EV charging in our network models to determine if capacity upgrades will be required. In combination with other system needs on a particular circuit, there could be multiple ways to plan for solutions such as traditional asset upgrades, strategic battery placements, optimally placed circuit ties, optimal DER placements, etc.
FERC Order 2222
Importance of FERC Order 2222

→ FERC Order No. 2222 enables distributed energy resources (DERs) aggregators to compete in wholesale electric markets such as MISO.

→ DERs can range from solar to battery storage, demand response, energy efficiency, thermal storage, electric vehicles and their charging equipment. DERs can locate on the distribution system and/or behind a customer meter.

Distribution Planning Considerations:

→ Distribution Aggregation studies will need to be completed.
→ Furthers the need for connected T&D systems, processes, and interconnection portals as DER is integrated into MISO markets.
→ Modernization of interconnection databases for tracking all DERs and their technical specifications.
→ Potential for significant increases to DER interconnection study volumes, complexity, and size expected.
→ Long-term forecasting of DERs, DERAs, and their performance impacts.
→ Potential need for distribution energy storage locally to manage the variability on each circuit.

Expedites and further justifies the need to expand smart grid operations & programs (AMI, ADMS, GIS, etc.).

→ Basic levels of visibility and monitoring will be required for the continued safe operation of the system.
→ Need to perform RTO day ahead and real time market studies with adequate visibility and monitoring.
→ Enhancement of distribution system operator and market roles.
Conclusion

Strategic Organizational Alignment between Resource & T&D planning

Advanced Demand Forecasting, Connected top-down & bottom-up load forecasting

Advanced Modeling & Analysis, utilization of advanced power flow tools

Cutting-Edge Grid Operations, Utilization of ADMS to be Grid of the Future
Final Q&A and Next Steps
Public Advisory Meeting

All meetings will be available for attendance via Teams. Meetings in 2022 may also occur in-person.

A Technical Meeting will be held the week preceding each Public Advisory Meeting for stakeholders with nondisclosure agreements. Tech Meeting topics will focus on those anticipated at the next Public Advisory Meeting.

Meeting materials can be accessed at www.aesindiana.com/integrated-resource-plan.
Thank You
Appendix
Wind Parameters

- **Location:** Indiana
- **Annual Capacity Factor:** 33.6 – 40.4%
- **Source Profile:** NREL System Advisory Model (SAM)
- **Project Size:** 50 MW ICAP
- **Useful Life:** 30 years
- **Summer ELCC (2025):** 7.1%; **Source:** Horizons Energy
- **Winter ELCC:** 20%; **Source:** MISO RAN
Solar Parameters

*Summer ELCC forecast presented in chart is from the Horizon Custom Reference Case – ELCC forecast will vary by custom scenario
Solar + Storage Parameters

- **Location:** Petersburg, Indiana
- **System:** DC Coupled Solar + Storage System, Storage charges exclusively from the solar array
- **Solar Component:** Identical to stand-alone solar (25 MW ICAP)
- **Storage Component:** 12.5 MW ICAP | 50 MWh
- **Synergies:** 4.3% reduction in capital costs, 2% improvement of RTE
- **Summer ELCC (2025):** 100%
- **Winter ELCC:** 48%

![Hybrid (Solar+Storage) ELCC](chart.png)
IRP Acronyms

IRP Acronyms

- CPCN: Certificate of Public Convenience and Necessity
- CT: Combustion Turbine
- CVD: Countervailing Duties
- CVR: Conservation Voltage Reduction
- DER: Distributed Energy Resource
- DERA: Distributed Energy Resource Aggregation
- DERMS: Distributed Energy Resource Management System
- DG: Distributed Generation
- DGPV: Distributed Generation Photovoltaic System
- DLC: Direct Load Control
- DOC: U.S. Department of Commerce
- DOE: U.S. Department of Energy
- DR: Demand Response
- DRR: Demand Response Resource
- DSM: Demand-Side Management
- DMS: Distribution Management System
- DSP: Distribution System Planning
- EE: Energy Efficiency
- EFORd: Equivalent Forced Outage Rate Demand
- EIA: Energy Information Administration
- ELCC: Effective Load Carrying Capability
- EM&V: Evaluation Measurement and Verification
- ESCR: Effective Selective Catalytic Reduction System
- EV: Electric Vehicle
- FLOC: Federated Learning of Cohorts
- GDP: Gross Domestic Product
- GFL: Grid-Following System
- GIS: Geographic Information System
- GT: Gas Turbine
- HDD: Heating Degree Day
- HVAC: Heating, Ventilation, and Air Conditioning
- IAC: Indiana Administrative Code
- IBR: Inverter-Based Resource
- IC: Indiana Code
- ICE: Intercontinental Exchange
- ICAP: Installed Capacity
- IE: Institute of Electrical and Electronics Engineers
- IRP: Integrated Resource Plan
IRP Acronyms

→ PRA: Planning Resource Auction
→ PSSE: Power System Simulator for Engineering
→ PTC: Renewable Electricity Production Tax Credit
→ PRMR: Planning Reserve Margin Requirement
→ PV: Photovoltaic
→ PVRR: Present Value Revenue Requirement
→ PY: Planning Year
→ RA: Resource Adequacy
→ RAN: Resource Availability and Need
→ RAP: Realistic Achievable Potential
→ RCx: Retrocommissioning
→ REC: Renewable Energy Credit
→ REP: Renewable Energy Production
→ RFP: Request for Proposals
→ RIIA: MISO’s Renewable Integration Impact Assessment
→ RTO: Regional Transmission Organization
→ SAC: MISO’s Seasonal Accredited Capacity
→ SAE: Small Area Estimation
→ SCADA: Supervisory Control and Data Acquisition
→ SCR: Selective Catalytic Reduction System
→ SEM: Strategic Energy Management
→ SO2: Sulfur Dioxide
→ SMR: Small Modular Reactors
→ ST: Steam Turbine
→ SUFG: State Utility Forecasting Group
→ T&D: Transmission and Distribution
→ TOU: Time-of-Use
→ UCT: Utility Cost Test
→ UCAP: Unforced Capacity
→ VAR: Volt-Amp Reactive
→ VPN: Virtual Private Network
→ WTP: Willingness to Participate
→ XEFORd: Equivalent Forced Outage Rate Demand excluding causes of outages that are outside management control
2022 Integrated Resource Plan (IRP)

Public Advisory Meeting #4
9/19/2022
Stewart Ramsay, Managing Executive, Vanry & Associates
# Agenda

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>Speakers</th>
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<tr>
<td><strong>Morning</strong></td>
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<td>Starting at 10:00 AM</td>
<td>Virtual Meeting Protocols and Safety</td>
<td>Chad Rogers, Director, Regulatory Affairs, AES Indiana</td>
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<td></td>
<td>Welcome and Opening Remarks</td>
<td>Kristina Lund, President &amp; CEO, AES Indiana</td>
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<td>Stakeholder Presentations</td>
<td>Bhawramaett Broehm, Market Development Analyst, Wartsila Marcus Nichol, Senior Director, Nuclear Energy Institute</td>
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<td>IRP Schedule &amp; Timeline</td>
<td>Erik Miller, Manager, Resource Planning, AES Indiana</td>
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<td>IRP Framework Review &amp; Modeling Updates</td>
<td>Erik Miller, Manager, Resource Planning, AES Indiana</td>
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<td>Retirement &amp; Replacement Analysis Results</td>
<td>Erik Miller, Manager, Resource Planning, AES Indiana</td>
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<td><strong>Break</strong></td>
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<td>12:00 PM – 12:30 PM</td>
<td>Lunch</td>
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<td><strong>Afternoon</strong></td>
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<tr>
<td>Starting at 12:30 PM</td>
<td>Replacement Resource Cost Sensitivity Analysis</td>
<td>Erik Miller, Manager, Resource Planning, AES Indiana</td>
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<td>Results</td>
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<td>Preliminary IRP Scorecard Results</td>
<td>Erik Miller, Manager, Resource Planning, AES Indiana</td>
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<td>Final Q&amp;A and Next Steps</td>
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Virtual Meeting
Protocols and Safety

Chad Rogers, Director, Regulatory Affairs, AES Indiana
IRP Team Introductions

AES Indiana Leadership Team
Kristina Lund, President & CEO, AES Indiana
Aaron Cooper, Chief Commercial Officer, AES Indiana
Brandi Davis-Handy, Chief Customer Officer, AES Indiana
Tanya Sovinski, Senior Director, Public Relations, AES Indiana
Ahmed Pasha, Chief Financial Officer, AES Indiana
Tom Raga, Vice President Government Affairs, AES Indiana
Sharon Schroder, Senior Director, Regulatory Affairs, AES Indiana
Kathy Storm, Vice President, US Smart Grid, AES Indiana

AES Indiana IRP Planning Team
Joe Bocanegra, Load Forecasting Analyst, AES Indiana
Erik Miller, Manager, Resource Planning, AES Indiana
Scott Perry, Manager, Regulatory Affairs, AES Indiana
Chad Rogers, Director, Regulatory Affairs, AES Indiana
Mike Russ, Senior Manager, T&D Planning & Forecasting, AES Asset Management
Brent Selvidge, Engineer, AES Indiana
Will Vance, Senior Analyst, AES Indiana
Kelly Young, Director, Public Relations, AES Indiana

AES Indiana IRP Partners
Annette Brocks, Senior Resource Planning Analyst, ACES
Patrick Burns, PV Modeling Lead and Regulatory/IRP Support, Brightline Group
Eric Fox, Director, Forecasting Solutions, Itron
Jeffrey Huber, Overall Project Manager and MPS Lead, GDS Associates
Jordan Janflone, EV Modeling Forecasting, GDS Associates
Patrick Maguire, Executive Director of Resource Planning, ACES
Hisham Othman, Vice President, Transmission and Regulatory Consulting, Quanta Technology
Stewart Ramsey, Managing Executive, Vanry & Associates
Mike Russo, Forecast Consultant, Itron
Jacob Thomas, Market Research and End-Use Analysis Lead, GDS Associates
Melissa Young, Demand Response Lead, GDS Associates
Danielle Powers, Executive Vice President, Concentric Energy Advisors
Meredith Stone, Senior Project Manager, Concentric Energy Advisors

AES Indiana Legal Team
Nick Grimmer, Indiana Regulatory Counsel, AES Indiana
Teresa Morton Nyhart, Counsel, Barnes & Thornburg LLP
Welcome to Today’s Participants

Advanced Energy Economy
Alliance Coal
Barnes & Thornburg LLP
Bose, McKinney & Evans LLP
CenterPoint Energy
Citizens Action Coalition
City of Indianapolis
Clean Grid Alliance
Demand Side Analytics
Develop Indy | Indy Chamber
Energy Futures Group
Faith in Place
Hallador Energy
Hoosier Energy
Hoosier Environmental Council
IBEW Local Union 1395
Indiana Chamber
Indiana DG
Indiana Distributed Energy Alliance
Indiana Energy Association
Indiana Office of Energy Development
Indiana Utility Regulatory Commission
Indiana State Conference of the NAACP

IUPUI
M&G
Midwest Energy Efficiency Alliance
Midcontinent Independent System Operator (MISO)
NIPSCO
Nuclear Energy Institute
NuScale Power
Office of Utility Consumer Counselor
Power Takeoff
Purdue - State Utility Forecasting Group
Ranger Power
Rolls-Royce/ISS
Sierra Club
Solar United Neighbors
UUI Green Team
Wartsila

... and members of the AES Indiana team and the public!
Virtual Meeting Best Practices

Questions

→ Your candid feedback and input is an integral part to the IRP process.
→ Questions or feedback will be taken at the end of each section.
→ Feel free to submit a question in the chat function at any time and we will ensure those questions are addressed.

Audio

→ All lines are muted upon entry.
→ For those using audio via Teams, you can unmute by selecting the microphone icon.
→ If you are dialed in from a phone, press *6 to unmute.

Video

→ Video is not required. To minimize bandwidth, please refrain from using video unless commenting during the meeting.
AES Purpose & Values

Accelerating the future of energy, together.

Safety first

Highest standards

All together
Safety First

1. AES Indiana strives to provide a place of employment that is free from recognized hazards and one that meets or exceeds governmental regulations regarding occupational health and safety.

2. AES Indiana considers occupational health and safety a fundamental value of the organization and is a key performance indicator of the overall success of the company.

3. AES Indiana's ultimate objective is that each day all AES Indiana people, contractors, and the public we serve return home to their family, friends, and community free from harm.
**Advisory Meeting #1 (January 24):** AES Indiana Resource Planning team recapped the 2019 IRP Short-Term Action Plan, introduced the IRP resource planning process and model overview, and highlighted existing resources, replacement resource options and future IRPs.

**Advisory Meeting #2 (April 12):** AES Indiana Resource Planning team presented load scenarios, results of the market potential study, commodity forecasts and distribution system planning items, and shared additional analysis of reliability that will give insight into how AES Indiana is working to ensure any changes to its portfolio maintain reliable service 24/7/365 for its customers.
Advisory Meeting #3 (June 27): AES Indiana’s Resource Planning team discussed system planning and RTO reliability planning, presented content on modeling reliability, and provided an overview of Portfolio metrics and scorecard. We welcomed presentations from MISO, Sierra Club and Faith in Place.

Today, the AES Indiana Resource Planning team will cover results from preliminary core IRP modeling and the scorecard, which evaluates multiple strategies and scenarios using defined cost, environmental, reliability and risk metrics.

We thank you for your input into this important process!
AES Indiana and the IRP

→ The IRP is a unique opportunity for AES Indiana to engage with our customers, communities and stakeholders to analyze our energy future, together.

→ The in-depth analysis and stakeholder input will position AES Indiana to best serve our customers’ needs today and well into the future.
AES Indiana and Our Stakeholders

→ The IRP process has allowed us to engage with many stakeholders through our Advisory Meetings and Technical Meetings and through their participation, questions, input and stakeholder presentations.

→ We are listening and taking feedback seriously. Through our collaboration, the IRP team has:
  → Evaluated all feedback
  → Added the Clean Energy Strategy
  → Worked collaboratively with stakeholders on key inputs
Meeting our customers’ needs today and tomorrow

AES Indiana is leading the inclusive, clean energy transition.
Stakeholder Presentations

Bhawramaett Broehm, Market Development Analyst, Wartsila
Stakeholder Presentations

Marcus Nichol, Senior Director, Nuclear Energy Institute
IRP Schedule & Timeline

Erik Miller, Manager, Resource Planning, AES Indiana
Updated 2022 IRP Timeline

Market Potential Study – Includes biweekly stakeholder meetings
Load Forecast
Distribution System Planning
Other Inputs & Assumptions

Core IRP Modeling
Portfolio Evaluation & Risk
Report Narrative
Issue and Evaluate Generation RFP

AES Indiana is available for additional touchpoints with stakeholders to discuss IRP-related topics.
Public Advisory Schedule

Public Advisory Meeting #1 – January 24, 2022
- 2022 IRP Schedule & Progress
- 2019 IRP Recap
- Load, EV, DG Forecasts
- MPS Overview

Public Advisory Meeting #2 – April 12, 2022
- Load Scenarios
- MPS Results & DSM Inputs
- Replacement Resource Assumptions
- IRP Portfolio Matrix & Scenario Framework

Public Advisory Meeting #3 – June 27, 2022
- Stakeholder Presentations
- Portfolio Metrics & Scorecard Framework
- MISO Reliability Planning
- IRP Reliability Analysis
- Distribution System Plan

Public Advisory Meeting #4 – September 19, 2022
- Preliminary Modeling Results
- Preliminary Scorecard Results

Public Advisory Meeting #5 – October/November
- Risk Analysis
- Reliability Analysis
- Final Scorecard Review
- Preferred Resource Portfolio & Short-Term Action Plan

Topics for meeting 5 are subject to change.
IRP Process Overview

Core IRP Modeling & Evaluation

- **DSM Market Potential Study (MPS)**
  - End Use Analysis
  - Comprehensive measure list
  - Measure uptake & potentials: MAP & RAP
  - Develop IRP model inputs (bundles)

- **Replacement Resource Costs**
  - Cost assumptions from 2020 RFP and Consultants, e.g. Wood Mackenzie, NREL
  - New RFP issued

- **Distribution System Planning (DSP)**
  - Bottom-up forecast on sample of constrained circuits
  - Assess EV and DG impacts
  - Load shapes inform IRP analysis

- **Load Forecast**
  - Itron SAE Methodology
  - Base, High & Low Scenarios
  - IRP model peak and energy inputs

- **Capacity Expansion Modeling**
  - Retirement and replacement analysis
  - Portfolio optimization

- **Production Cost Modeling & PVRR**
  - Prod Cost - Portfolio dispatch analysis serve as PVRR inputs
  - Portfolio PVRR analysis
  - Stochastic risk analysis

- **Portfolio Evaluation & Short-Term Action Plan**
  - Screen against Evaluation Criteria
  - Selection of Preferred Resource Portfolio & Short-Term Action Plan

- **Contributors:**
  - DSM MPS – GDS Associates
  - RFP – Sargent and Lundy
  - DSP – Internal & Conrad Technical Services
  - Load Forecast – Itron
  - PVRR Calculations – Concentric
  - Reliability Analysis – Quanta
  - IRP Modeling & Evaluation – Internal with ACES & Anchor Power support

- **IRP Submission Dec. 1, 2022**

- **IRP-driven Filings**
  - DSM Filing
  - Certificate of Public Convenience and Necessity (CPCN) Filing
Modeling Updates & IRP Framework Review

Erik Miller, Manager, Resource Planning, AES Indiana
Model Constraints

Capacity Expansion models require constraints to provide meaningful results. There are three main constraints AES Indiana utilized:

**Limiting Capacity Purchases and Sales**

→ Prevents the selection of a portfolio that relies excessively on market purchases for capacity or on uncertain revenues associated with selling capacity. The constraint is ~50 MW.

**Limiting Energy Purchases and Sales**

→ Selects a portfolio that covers at least 90% of AES Indiana’s energy sales on an annual basis, limiting reliance on the market.

→ Also prevents a portfolio that sells more than 10% above AES Indiana's expected energy sales on an annual basis, limiting reliance on uncertain energy revenue. Excess generation is assumed to be curtailed.
Model Constraints (continued)

Limiting the Build of New Resources

→ Prevents the model from selecting resources in the near term that cannot practically be executed and are not supported by recent RFP responses.

→ Earliest build is ~1,500 MW (ICAP) of Solar, Storage, and Hybrids in 2025

→ By 2027, can build ~1,000 MW (ICAP) of any technology per year

→ Over the 20-year time span, can build a max of ~2,000 MW of any one technology
Inflation Reduction Act of 2022 (IRA) included in Current Trends

- IRA passed House and Senate and signed into law in August
- Legislation changes the Current Trends (Reference Case) assumptions for the ITC and PTC

**Original** – as presented in Public Advisory Meeting #2, April 12, 2022

**Updated** – aligns with the IRA tax provisions

*Years correspond to years projects first produce energy*
Forecast for NOx allowance prices updated based on current market trends

- Scarcity within the NOx allowance market has driven prices to historic highs
- Updated prices included in the Current Trends (Reference Case), Aggressive Environmental and Decarbonized Economy Scenarios
Modeling Updates

Carbon Tax moved from starting in 2035 to starting in 2028 in the Aggressive Environmental Scenario

→ Change made to provide a reasonably aggressive environmental scenario

→ Aligns with the Interagency Working Group Social Cost of Carbon Forecast (5% Discount Rate)

[Graph showing carbon tax costs from 2023 to 2042, with jumps indicating the change in starting year.]
The Decarbonization Scenario captures a bookend with an aggressive grid transition to renewable energy generation. This is accomplished through a progressive Renewable Portfolio Standard (RPS):

- RPS target, penalties, and grants are based on the theoretical Clean Energy Performance Program:
  - Failure to hit the RPS results in a $40/MWh penalty, per MWh of shortfall
  - Exceeding the RPS results in a $150/MWh grant, per MWh of exceedance
### Structure for Today’s Review

**Retirement & Replacement Analysis Review:** Review the optimized portfolios and complete the Portfolio Matrix

<table>
<thead>
<tr>
<th>Generation Strategies</th>
<th>Scenarios</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Environmental Action</td>
</tr>
<tr>
<td>No Early Retirement</td>
<td></td>
</tr>
<tr>
<td>Pete Refuel to 100% Gas (est. 2025)</td>
<td></td>
</tr>
<tr>
<td>One Pete Unit Retires (2026)</td>
<td></td>
</tr>
<tr>
<td>Both Pete Units Retire (2026 &amp; 2028)</td>
<td></td>
</tr>
<tr>
<td>“Clean Energy Strategy” Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
<td></td>
</tr>
<tr>
<td>Encompass Optimization without predefined Strategy</td>
<td></td>
</tr>
</tbody>
</table>

Portfolio cost (PVRR) will be calculated for each portfolio to complete Portfolio Matrix

→ Review generation mixes and PVRR in the Current Trends (Reference Case)
→ Complete the Portfolio Matrix and compare PVRR
→ Review the Replacement Resource Cost Sensitivity Analysis
### Structure for Today’s Review

#### 2. Review key IRP Scorecard Metrics for the Current Trends (Reference Case)

<table>
<thead>
<tr>
<th>Affordability</th>
<th>Environmental Sustainability</th>
<th>Reliability, Stability &amp; Resiliency</th>
<th>Risk &amp; Opportunity</th>
<th>Economic Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-yr PVRR</td>
<td></td>
<td>Reliability Score</td>
<td>Environmental Policy Opportunity</td>
<td>Renewable Capital Cost Risk (+50%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Environment Risk</td>
<td>Cost Opportunity</td>
<td>Employees (+/-)</td>
</tr>
<tr>
<td>Present Value</td>
<td></td>
<td>Policy Risk</td>
<td>Cost Risk</td>
<td>Property Taxes</td>
</tr>
<tr>
<td>of Revenue</td>
<td></td>
<td>Mean - P95</td>
<td>Market Exposure</td>
<td>Total FTEs</td>
</tr>
<tr>
<td>Requirements</td>
<td></td>
<td>P95 - Mean</td>
<td>Cost Risk</td>
<td>associated with generation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total amount of property tax paid from AES IN assets</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Composite score from</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reliability Analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lowest PVRR across policy scenarios</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Highest PVRR across policy scenarios</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total portfolio CO2 Emissions (mmtons)</td>
<td>% Renewable Energy in 2032</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total portfolio SO2 Emissions (tons)</td>
<td>Coal Combustion Products (CCP)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water Use (m高尔)</td>
<td>Clean Energy Progress</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Total portfolio NOx Emissions (tons)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Water Use (m高尔)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>CCP (tons)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
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</tr>
<tr>
<td>5</td>
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<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Calculations for each scoring metric will be included to complete the Scorecard.

#### Strategies
- 1. No Early Retirement
- 2. Pete Refuel to 100% Natural Gas (est. 2025)
- 3. One Pete Unit Retires in 2026
- 4. Both Pete Units Retire in 2026 & 2028
- 5. “Clean Energy Strategy” – Both Pete Units Retire and replaced with Renewables in 2026 & 2028
- 6. Encompass Optimization without Predefined Strategy

- Review PVRR, emissions and economic metrics
- Reliability and risk analysis still in-progress and will be presented in Meeting #5
I. Retirement and Replacement Analysis Results

Erik Miller, Manager, Resource Planning, AES Indiana
These are two very different planning/market concepts.

1) Capacity Planning
- MISO requires utilities to have enough generation resources to meet their peak hour plus a reserve margin (buffer). This is called a Planning Reserve Margin Requirement (PRMR).
- Historically, MISO planning has been based on only the summer peak hour + buffer/PRMR.
- This changed earlier in the month when FERC approved MISO’s seasonal construct – Utilities now are required to have enough generation to serve their peak hour + buffer/PRMR in all four seasons – summer, fall, winter and spring.
- With the seasonal construct, AES Indiana now has a higher winter peak hour + buffer/PRMR than summer.
- There’s a market for capacity – thus, AES Indiana assigns a monetary value to capacity for modeling purposes - $89/kW-yr.
2) Energy Planning
• Most people are familiar with energy – this is a MWh that is produced or purchased to supply customers.
• For planning purposes, AES Indiana can build generation to supply energy for its customers or rely on the market. Relying on the market for energy comes with both price and reliability risks to customers.
• Energy planning is where we can really make an impact on emissions.

Differences in Resource Types
• Certain resources are better suited for supplying capacity –
  • Thermal and battery energy storage resources are dispatchable – therefore, MISO gives them almost full credit as a capacity resource in all seasons.
  • Wind and solar are not dispatchable (utilities can’t control when they are on) – therefore, MISO correspondingly adjusts down their capacity value, e.g. a 200 MW solar resource receives zero capacity value (ELCC) in the winter.
  • A resource can be built for its capacity value and run very little to supply energy. It’s there when the system really needs it!
Historically, AES Indiana has only had to plan for its summer peak + buffer/PRMR.

This changed in early September when FERC approved MISO’s four-season capacity construct.

AES has a winter capacity shortage in the near-term regardless of unit retirements.

Unfortunately, based on MISO’s accreditation, solar receives no value in the winter and wind receives only 18% of its full value.

The planning model can only select thermal or battery energy storage resources to fill this winter capacity need. Solar can be combined with battery energy storage if economic.
## Summary of Scenario Driving Assumptions

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Load</th>
<th>EV</th>
<th>Dist Solar</th>
<th>Power</th>
<th>Gas</th>
<th>Coal</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Environmental Action – “No Env”</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Horizon Fundamental Forecast</td>
<td>Low</td>
<td>Base</td>
<td>None</td>
</tr>
<tr>
<td>Current Trends (Reference Case) – “Ref”</td>
<td>Base</td>
<td>Base</td>
<td>Base</td>
<td>Horizon Fundamental Forecast</td>
<td>Base</td>
<td>Base</td>
<td>Low</td>
</tr>
<tr>
<td>Aggressive Environmental – “AE”</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Horizon Fundamental Forecast</td>
<td>High</td>
<td>Base</td>
<td>High</td>
</tr>
<tr>
<td>Decarbonized Economy – “Decarb”</td>
<td>High</td>
<td>Very High</td>
<td>High</td>
<td>Horizon Fundamental Forecast</td>
<td>Base</td>
<td>Base</td>
<td>None*</td>
</tr>
</tbody>
</table>

*Carbon targets will be modeled through a National Renewable Portfolio Standard
Current Trends Assumptions Review

The following slides provide the Portfolio Summaries for the Current Trends Scenario – these are the candidate portfolios. Portfolio Summaries will include the following:

→ Generation mix and Unforced Capacity position
→ Installed capacity over the planning period
→ % energy mix to serve load
→ DSM Selections
→ PVRR

As a review, the Current Trends Scenario includes the following driving assumptions:

→ Base Power, Gas, and Coal Prices
→ Base NOx Prices
→ ITC & PTC assumptions aligned with the Inflation Reduction Act
→ Low Carbon Price at $6.49/ton starting in 2028 and escalating annually at 4.6%
→ Base load, EV and customer solar forecasts

This section will conclude with a comparison of the PVRRs for the Strategies and Scenarios in the Portfolio Matrix.

Note: The Portfolio Summaries for the No Environmental Action, Aggressive Environmental and Decarbonized Economy scenarios are included in the appendix of this presentation.
A. No Early Retirement

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>No Environmental Action</th>
<th>Current Trends</th>
<th>Aggressive Environmental</th>
<th>Decarbonized Economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>$9,572</td>
<td>$9,572</td>
<td>$9,572</td>
<td>$9,572</td>
<td>$9,572</td>
</tr>
</tbody>
</table>
No Early Retirement: Current Trends (Reference Case)

Firm Unforced Capacity Position – Summer
No Early Retirement: Current Trends (Reference Case)

Firm Unforced Capacity Position – Winter

- Existing Coal
- Existing Natural Gas
- Existing Other (Wind/Solar/DR)
- New Wind
- New Storage
- New Solar + Storage
- New Natural Gas
- New Solar
- Capacity Purchases
- PRMR
- PRMR less DSM

UCAP MW

0 500 1,000 1,500 2,000 2,500 3,000 3,500 4,000

2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042
### Installed Capacity Cumulative Additions (MW)

![Bar chart showing cumulative capacity additions from 2022 to 2028 by technology: DSM (EE & DR), Wind, Solar, Storage, Solar + Storage, and Natural Gas.]

### Installed Capacity Incremental Additions (MW): 2023 - 2028

<table>
<thead>
<tr>
<th></th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2028</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>500</td>
<td>0</td>
</tr>
<tr>
<td>Solar</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Storage</td>
<td>0</td>
<td>0</td>
<td>240</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Solar + Storage</td>
<td>0</td>
<td>0</td>
<td>45</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
No Early Retirement: Current Trends *(Reference Case)*

**Energy Mix %**

- **2023:**
  - Coal: 42%
  - Natural Gas: 50%
  - Wind: 5%
  - Solar + Storage: 3%
  - DSM: 5%

- **2032:**
  - Thermal MWh %: 75%
  - Renewable/DSM MWh %: 25%

- **2042:**
  - Thermal MWh %: 19%
  - Renewable/DSM MWh %: 81%

- **Thermal MWh %:**
  - 2022: 92%
  - 2032: 55%
  - 2042: 13%

- **Renewable/DSM MWh %:**
  - 2022: 8%
  - 2032: 45%
  - 2042: 87%
## DSM Results

### Energy Efficiency:

<table>
<thead>
<tr>
<th></th>
<th>Vintage 1</th>
<th>Vintage 2</th>
<th>Vintage 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2024 - 2026</td>
<td>2027 - 2029</td>
<td>2030 - 2042</td>
</tr>
<tr>
<td>Efficient Products - Lower Cost</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Efficient Products - Higher Cost</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Behavioral</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appliance Recycling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multifamily</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IQW</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residential Efficient Products - Lower Cost (excluding Income Qualified Weatherization (IQW))</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower Cost Residential (excluding IQW)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher Cost Residential (excluding IQW)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Demand Response:

<table>
<thead>
<tr>
<th></th>
<th>2026 - 2042</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>Direct Load Control</td>
</tr>
<tr>
<td>Residential Rates</td>
<td></td>
</tr>
<tr>
<td>C&amp;I</td>
<td>Direct Load Control</td>
</tr>
<tr>
<td>C&amp;I Rates</td>
<td></td>
</tr>
<tr>
<td>Cumulative Summer MW</td>
<td>75 MW</td>
</tr>
</tbody>
</table>

### Impacts

<table>
<thead>
<tr>
<th></th>
<th>Avg Annual MWh</th>
<th>Avg Annual MWh</th>
<th>Avg Annual MWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>2022</td>
<td>134,263</td>
<td>141,526</td>
<td>146,428</td>
</tr>
<tr>
<td>% of 2021 Sales ex. Opt-Out</td>
<td>1.1%</td>
<td>1.1%</td>
<td>1.2%</td>
</tr>
<tr>
<td>Cumulative Summer MW</td>
<td>89 MW</td>
<td>92 MW</td>
<td>303 MW</td>
</tr>
</tbody>
</table>

**Note:** Boxes highlighted in purple denote DSM bundles that were selected by Encompass.
No Early Retirement: Current Trends (Reference Case)

Portfolio Overview

Retirements
Harding Street:
- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
  → Total Nat Gas Retired MW: 618 MW

Replacement Additions by 2042
- DSM: 490 MW
- Wind: 2,500 MW
- Solar: 2,080 MW
- Storage: 700 MW
- Solar + Storage: 45 MW
- Thermal: 0 MW

Current Trends PVRR Summary
20-Year PVRR (2023$MM, 2023-2042)

<table>
<thead>
<tr>
<th>Strategy</th>
<th>PVRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Early Retirement</td>
<td>$9,572</td>
</tr>
<tr>
<td>Pete Refuel to 100% Gas (est. 2025)</td>
<td>$9,330</td>
</tr>
<tr>
<td>One Pete Unit Retires (2026)</td>
<td>$9,773</td>
</tr>
<tr>
<td>Both Pete Units Retire (2026 &amp; 2028)</td>
<td>$9,618</td>
</tr>
<tr>
<td>“Clean Energy Strategy”</td>
<td>$9,711</td>
</tr>
<tr>
<td>Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage</td>
<td></td>
</tr>
<tr>
<td>(2026 &amp; 2028)</td>
<td></td>
</tr>
<tr>
<td>Encompass Optimization without predefined Strategy – Selects Pete</td>
<td></td>
</tr>
<tr>
<td>3 Refuel in 2025 &amp; Pete 4 Refuel in 2027</td>
<td>$9,262</td>
</tr>
</tbody>
</table>
## B. Pete Refuel by 2025

The table below outlines the projected costs under different environmental action scenarios by 2025.

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Environmental Action</td>
<td></td>
</tr>
<tr>
<td>Current Trends</td>
<td></td>
</tr>
<tr>
<td>Aggressive Environmental</td>
<td>$9,330</td>
</tr>
<tr>
<td>Decarbonized Economy</td>
<td></td>
</tr>
</tbody>
</table>
Pete 3 & 4 Refuel in 2025: Current Trends (Reference Case)

Firm Unforced Capacity Position – Summer

- Existing Coal
- New Wind
- New Natural Gas
- Petersburg 3 & 4 Refuel to Natural Gas
- Existing Natural Gas
- Existing Other (Wind/Solar/DR)
- New Solar + Storage
- New Solar
- New Storage
- Capacity Purchases
- PRMR
- PRMR less DSM
Pete 3 & 4 Refuel in 2025: Current Trends (Reference Case)

Firm Unforced Capacity Position – Winter

Existing Coal
New Wind
New Solar
Petersburg 3 & 4 Refuel to Natural Gas
Existing Natural Gas
Existing Other (Wind/Solar/DR)
New Storage
New Solar + Storage
New Natural Gas
Capacity Purchases
PRMR
PRMR less DSM
Pete 3 & 4 Refuel in 2025: Current Trends (Reference Case)

Installed Capacity Cumulative Additions (MW)

Installed Capacity Incremental Additions (MW): 2023 - 2028

<table>
<thead>
<tr>
<th></th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2028</th>
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<tbody>
<tr>
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<td>0</td>
<td>1,052</td>
<td>0</td>
<td>0</td>
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</tr>
<tr>
<td>Wind</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>50</td>
<td>450</td>
</tr>
<tr>
<td>Solar</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
</tr>
<tr>
<td>Storage</td>
<td>0</td>
<td>0</td>
<td>240</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Solar + Storage</td>
<td>0</td>
<td>0</td>
<td>45</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Pete 3 & 4 Refuel in 2025: Current Trends (Reference Case)

Energy Mix %

2023
- Coal: 5%
- Natural Gas: 3%
- Wind: 42%
- Solar + Storage: 50%
- DSM: 7%

2032
- Coal: 17%
- Natural Gas: 7%
- Wind: 45%
- Solar + Storage: 32%
- DSM: 8%

2042
- Coal: 8%
- Natural Gas: 13%
- Wind: 46%
- Solar + Storage: 17%
- DSM: 5%

Thermal MWh % 92% 45% 13%
Renewable/DSM MWh % 8% 55% 87%
## DSM Results

### Energy Efficiency:

<table>
<thead>
<tr>
<th>Vintage 1 (2024 - 2026)</th>
<th>Vintage 2 (2027 - 2029)</th>
<th>Vintage 3 (2030 - 2042)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>School Education</td>
<td>Appliance Recycling</td>
<td></td>
</tr>
<tr>
<td>Multifamily</td>
<td>IQW</td>
<td>IQW</td>
</tr>
<tr>
<td>Residential</td>
<td>Prescriptive</td>
<td>C&amp;I</td>
</tr>
<tr>
<td></td>
<td>Custom SEM</td>
<td>C&amp;I</td>
</tr>
<tr>
<td></td>
<td>C&amp;I</td>
<td>C&amp;I</td>
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### Demand Response:

<table>
<thead>
<tr>
<th>2026 - 2042</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
</tr>
<tr>
<td>Direct Load Control</td>
</tr>
<tr>
<td>Residential Rates</td>
</tr>
<tr>
<td>C&amp;I</td>
</tr>
<tr>
<td>Direct Load Control</td>
</tr>
<tr>
<td>C&amp;I Rates</td>
</tr>
<tr>
<td>Cumulative Summer MW</td>
</tr>
<tr>
<td>75 MW</td>
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</tbody>
</table>

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### Note:

Boxes highlighted in purple denote DSM bundles that were selected by Encompass.

---

Pete 3 & 4 Refuel in 2025: Current Trends (Reference Case)
Portfolio Overview

**Retirements**

Petersburg:
- Pete 3 & 4 Coal: 2025 Refuel with Nat Gas
  - Total Refueled MW: 1,040 MW

Harding Street:
- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
  - Total Nat Gas Retired MW: 618 MW

**Replacement Additions by 2042**

- DSM: 490 MW
- Wind: 2,500 MW
- Solar: 1,983 MW
- Storage: 620 MW
- Solar + Storage: 225 MW
- Thermal: 0
- Pete 3 & 4 Refueled to Nat Gas: 1,000 MW

### Current Trends PVRR Summary

<table>
<thead>
<tr>
<th>Strategy</th>
<th>PVRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Early Retirement</td>
<td>$9,572</td>
</tr>
<tr>
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<td>$9,330</td>
</tr>
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<td>$9,773</td>
</tr>
<tr>
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</tr>
<tr>
<td>“Clean Energy Strategy”</td>
<td>$9,711</td>
</tr>
<tr>
<td>Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
<td></td>
</tr>
<tr>
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<td>$9,262</td>
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## C. One Pete Unit Retires (2026)

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>No Environmental Action</th>
<th>Current Trends</th>
<th>Aggressive Environmental</th>
<th>Decarbonized Economy</th>
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<tbody>
<tr>
<td>$9,773</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
One Pete Unit Retires (2026): Current Trends (Reference Case)

Firm Unforced Capacity Position – Summer

- Existing Coal
- Existing Natural Gas
- Existing Other (Wind/Solar/DR)
- New Wind
- New Storage
- New Solar + Storage
- New Solar
- New Natural Gas
- Capacity Purchases
- PRMR
- PRMR less DSM
One Pete Unit Retires (2026): Current Trends (Reference Case)
One Pete Unit Retires (2026): Current Trends (Reference Case)

Installed Capacity Cumulative Additions (MW)

Installed Capacity Incremental Additions (MW): 2023 - 2028

<table>
<thead>
<tr>
<th></th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2028</th>
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<tbody>
<tr>
<td>Wind</td>
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<td>0</td>
<td>0</td>
<td>100</td>
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<td>Solar</td>
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<tr>
<td>Storage</td>
<td>0</td>
<td>0</td>
<td>300</td>
<td>400</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Solar + Storage</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Natural Gas</td>
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<td>0</td>
<td>0</td>
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<td>0</td>
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One Pete Unit Retires (2026): Current Trends (Reference Case)
## DSM Results

### Energy Efficiency:

<table>
<thead>
<tr>
<th>Vintage 1</th>
<th>Vintage 2</th>
<th>Vintage 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>2024 - 2026</td>
<td>2027 - 2029</td>
<td>2030 - 2042</td>
</tr>
</tbody>
</table>

- **Residential**
  - Efficient Products - Lower Cost
  - Efficient Products - Higher Cost
  - Behavioral
  - School Education
  - Appliance Recycling
  - Multifamily
  - IQW

- **C&I**
  - Prescriptive
  - Custom
  - Custom RCx
  - Custom SEM

### Demand Response:

- **2026 - 2042**
  - Residential
    - Direct Load Control
    - Residential Rates
  - C&I
    - Direct Load Control
    - C&I Rates
    - Cumulative Summer MW
      - 75 MW

**Note**: Boxes highlighted in purple denote DSM bundles that were selected by Encompass

### Impacts

- **Avg Annual MWh**
  - Vintage 1: 131,578
  - Vintage 2: 141,526
  - Vintage 3: 146,428

- **% of 2021 Sales ex. Opt-Out**
  - Vintage 1: 1.0%
  - Vintage 2: 1.1%
  - Vintage 3: 1.2%

- **Cumulative Summer MW**
  - Vintage 1: 87 MW
  - Vintage 2: 92 MW
  - Vintage 3: 303 MW
One Pete Unit Retires (2026): Current Trends (Reference Case)

Portfolio Overview

Retirements

Petersburg:
- Pete 3 Coal: 2026
- Total Coal Retired MW: 520 MW

Harding Street:
- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
- Total Nat Gas Retired MW: 618 MW

Replacement Additions by 2042
- DSM: 490 MW
- Wind: 2,500 MW
- Solar: 2,340 MW
- Storage: 1,240 MW
- Solar + Storage: 45 MW
- Thermal: 0 MW

Current Trends PVRR Summary
20-Year PVRR (2023$MM, 2023-2042)

<table>
<thead>
<tr>
<th>Strategy</th>
<th>PVRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Early Retirement</td>
<td>$9,572</td>
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<td>Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
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<td>$9,262</td>
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### D. Both Pete Units Retire (2026 & 2028)

<table>
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<tr>
<th>Scenarios</th>
<th>No Environmental Action</th>
<th>Current Trends</th>
<th>Aggressive Environmental</th>
<th>Decarbonized Economy</th>
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<td></td>
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<td>$9,618</td>
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<td></td>
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Both Pete Units Retire: Current Trends (Reference Case) 2026 & 2028

Firm Unforced Capacity Position – Summer

UCAP MW

2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042

Existing Coal
Existing Natural Gas
Existing Other (Wind/Solar/DR)
New Wind
New Storage
New Solar + Storage
New Natural Gas
New Solar
Capacity Purchases
PRMR
PRMR less DSM
Both Pete Units Retire: Current Trends (Reference Case) 2026 & 2028

Firm Unforced Capacity Position – Winter
### Installed Capacity Cumulative Additions (MW)

#### Installed Capacity Incremental Additions (MW): 2023 – 2028

<table>
<thead>
<tr>
<th></th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2028</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind</td>
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<td>0</td>
<td>100</td>
<td>400</td>
<td>100</td>
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<td>Storage</td>
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<td>400</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>Solar + Storage</td>
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Both Pete Units Retire: Current Trends (Reference Case) 2026 & 2028
Both Pete Units Retire: Current Trends (Reference Case)

Energy Mix %

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<tr>
<th>Year</th>
<th>Coal</th>
<th>Natural Gas</th>
<th>Wind</th>
<th>Solar + Storage</th>
<th>DSM</th>
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</thead>
<tbody>
<tr>
<td>2023</td>
<td>50%</td>
<td>16%</td>
<td>26%</td>
<td>6%</td>
<td>8%</td>
</tr>
<tr>
<td>2026</td>
<td>42%</td>
<td>10%</td>
<td>30%</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>2028</td>
<td>30%</td>
<td>20%</td>
<td>30%</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>2032</td>
<td>20%</td>
<td>30%</td>
<td>30%</td>
<td>20%</td>
<td>8%</td>
</tr>
<tr>
<td>2042</td>
<td>10%</td>
<td>40%</td>
<td>40%</td>
<td>20%</td>
<td>13%</td>
</tr>
</tbody>
</table>

Thermal MWh % | Renewable/DSM MWh % | Thermal MWh % | Renewable/DSM MWh % | Thermal MWh % | Renewable/DSM MWh % |
---|---|---|---|---|---|
92% | 8% | 52% | 48% | 13% | 87%
### DSM Results

#### Energy Efficiency:

<table>
<thead>
<tr>
<th>Vintage</th>
<th>2024 - 2026</th>
<th>2027 - 2029</th>
<th>2030 - 2042</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Residential</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Efficient Products - Lower Cost</td>
<td>Lower Cost Residential (excluding Income Qualified Weatherization (IQW))</td>
<td>Lower Cost Residential (excluding IQW)</td>
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</tr>
<tr>
<td>Efficient Products - Higher Cost</td>
<td>Higher Cost Residential (excluding IQW)</td>
<td>Higher Cost Residential (excluding IQW)</td>
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<tr>
<td>School Education</td>
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<td></td>
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<tr>
<td>Appliance Recycling</td>
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<tr>
<td>Multifamily</td>
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<tr>
<td>IQW</td>
<td>IQW</td>
<td>IQW</td>
<td></td>
</tr>
<tr>
<td><strong>C&amp;I</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prescriptive</td>
<td>C&amp;I</td>
<td>C&amp;I</td>
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<tr>
<td>Custom</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Custom RCx</td>
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<tr>
<td>Custom SEM</td>
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<td></td>
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</tr>
<tr>
<td><strong>Impacts</strong></td>
<td>Avg Annual MWh</td>
<td>Avg Annual MWh</td>
<td>Avg Annual MWh</td>
</tr>
<tr>
<td></td>
<td>131,578</td>
<td>141,526</td>
<td>146,428</td>
</tr>
<tr>
<td>% of 2021 Sales ex. Opt-Out</td>
<td>1.0%</td>
<td>1.1%</td>
<td>1.2%</td>
</tr>
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<td>Cumulative Summer MW</td>
<td>87 MW</td>
<td>92 MW</td>
<td>303 MW</td>
</tr>
</tbody>
</table>

#### Demand Response:

<table>
<thead>
<tr>
<th>2026 - 2042</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Residential</strong></td>
<td>Direct Load Control</td>
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<tr>
<td><strong>C&amp;I</strong></td>
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</tr>
<tr>
<td>Cumulative Summer MW</td>
<td>195 MW</td>
</tr>
</tbody>
</table>

**Note:** Boxes highlighted in purple denote DSM bundles that were selected by Encompass.
Both Pete Units Retire: Current Trends (Reference Case) 2026 & 2028

Portfolio Overview

Retirements

Petersburg:
→ Pete 3 Coal: 2026
→ Pete 4 Coal: 2028
→ Total Coal Retired MW: 1,040 MW

Harding Street:
→ HS ST5 Nat Gas: 2030
→ HS ST6 Nat Gas: 2030
→ HS ST7 Nat Gas: 2033
→ Total Nat Gas Retired MW: 618 MW

Replacement Additions by 2042

→ DSM: 610 MW
→ Wind: 2,450 MW
→ Solar: 2,308 MW
→ Storage: 1,280 MW
→ Solar + Storage: 225 MW
→ Thermal: 325 MW

Current Trends PVRR Summary

20-Year PVRR (2023$MM, 2023-2042)

<table>
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## E. Clean Energy Strategy

### Retire & Replace Pete with Clean Energy

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>No Environmental Action</th>
<th>Current Trends</th>
<th>Aggressive Environmental</th>
<th>Decarbonized Economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>$9,711</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Clean Energy Strategy: Current Trends (Reference Case)

Firm Unforced Capacity Position – Summer

- Existing Coal
- Existing Natural Gas
- Existing Other (Wind/Solar/DR)
- New Wind
- New Storage
- New Solar + Storage
- New Natural Gas
- New Solar
- Capacity Purchases
- PRMR
- PRMR less DSM

UCAP MW

Year:
- 2022
- 2023
- 2024
- 2025
- 2026
- 2027
- 2028
- 2029
- 2030
- 2031
- 2032
- 2033
- 2034
- 2035
- 2036
- 2037
- 2038
- 2039
- 2040
- 2041
- 2042

MW:
- 0
- 500
- 1,000
- 1,500
- 2,000
- 2,500
- 3,000
- 3,500
- 4,000

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Clean Energy Strategy: Current Trends (Reference Case)

Retire & Replace Pete with Clean Energy

Firm Unforced Capacity Position – Winter

UCAP MW

Existing Coal
Existing Natural Gas
Existing Other (Wind/Solar/DR)
New Wind
New Storage
New Solar + Storage
New Natural Gas
New Solar
Capacity Purchases
PRMR
PRMR less DSM

2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042

0 500 1,000 1,500 2,000 2,500 3,000 3,500 4,000
### Clean Energy Strategy: Current Trends (Reference Case)

**Retire & Replace Pete with Clean Energy**

#### Installed Capacity Cumulative Additions (MW)

<table>
<thead>
<tr>
<th>Year</th>
<th>Wind</th>
<th>Solar</th>
<th>Storage</th>
<th>Solar + Storage</th>
<th>Gas</th>
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<tbody>
<tr>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
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</tr>
<tr>
<td>2025</td>
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<td>300</td>
<td>400</td>
<td>0</td>
</tr>
<tr>
<td>2026</td>
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<td>0</td>
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<tr>
<td>2028</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Installed Capacity Incremental Additions (MW): 2023 – 2028**

- **Wind**: 0 in 2023, 0 in 2024, 0 in 2025, 100 in 2026, 400 in 2027, 400 in 2028
- **Solar**: 0 in 2023, 0 in 2024, 0 in 2025, 0 in 2026, 0 in 2027, 0 in 2028
- **Storage**: 0 in 2023, 0 in 2024, 0 in 2025, 400 in 2026, 0 in 2027, 280 in 2028
- **Solar + Storage**: 0 in 2023, 0 in 2024, 0 in 2025, 0 in 2026, 0 in 2027, 45 in 2028
- **Natural Gas**: 0 in 2023, 0 in 2024, 0 in 2025, 0 in 2026, 0 in 2027, 0 in 2028
Clean Energy Strategy: Current Trends

Retire & Replace Pete with Clean Energy

Energy Mix %

<table>
<thead>
<tr>
<th>Year</th>
<th>Coal</th>
<th>Natural Gas</th>
<th>Wind</th>
<th>Solar + Storage</th>
<th>DSM</th>
</tr>
</thead>
<tbody>
<tr>
<td>2023</td>
<td>5%</td>
<td>3%</td>
<td>92%</td>
<td>6%</td>
<td>3%</td>
</tr>
<tr>
<td>2032</td>
<td>6%</td>
<td>36%</td>
<td>36%</td>
<td>36%</td>
<td>8%</td>
</tr>
<tr>
<td>2042</td>
<td>8%</td>
<td>36%</td>
<td>36%</td>
<td>36%</td>
<td>12%</td>
</tr>
</tbody>
</table>

Thermal MWh % | Renewable/DSM MWh %
---|---
92% | 8%
36% | 64%
12% | 88%
## DSM Results

### Energy Efficiency:

<table>
<thead>
<tr>
<th>Vintage 1 (2024 - 2026)</th>
<th>Vintage 2 (2027 - 2029)</th>
<th>Vintage 3 (2030 - 2042)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficient Products - Lower Cost</td>
<td>Lower Cost Residential (excluding IQW)</td>
<td>Lower Cost Residential (excluding IQW)</td>
</tr>
<tr>
<td>Efficient Products - Higher Cost</td>
<td>Behavioral</td>
<td></td>
</tr>
<tr>
<td>School Education</td>
<td>Appliance Recycling</td>
<td>Multifamily</td>
</tr>
<tr>
<td>IQW</td>
<td>IQW</td>
<td>IQW</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C&amp;I</th>
<th>Prescriptive</th>
<th>Custom</th>
<th>Custom RCx</th>
<th>Custom SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>C&amp;I</td>
<td>C&amp;I</td>
<td>C&amp;I</td>
<td>C&amp;I</td>
<td>C&amp;I</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Avg Annual MWh</th>
<th>Avg Annual MWh</th>
<th>Avg Annual MWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021 Sales ex. Opt-Out</td>
<td>134,263</td>
<td>141,526</td>
<td>146,428</td>
</tr>
<tr>
<td>% of 2021 Sales ex. Opt-Out</td>
<td>1.1%</td>
<td>1.1%</td>
<td>1.2%</td>
</tr>
<tr>
<td>Cumulative Summer MW</td>
<td>89 MW</td>
<td>92 MW</td>
<td>303 MW</td>
</tr>
</tbody>
</table>

### Demand Response:

<table>
<thead>
<tr>
<th>2026 - 2042</th>
<th>Residential</th>
<th>C&amp;I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Load Control</td>
<td>Direct Load Control</td>
<td>C&amp;I Rates</td>
</tr>
<tr>
<td>Residential Rates</td>
<td>C&amp;I Rates</td>
<td></td>
</tr>
<tr>
<td>Cumulative Summer MW</td>
<td>Cumulative Summer MW</td>
<td></td>
</tr>
<tr>
<td>195 MW</td>
<td>195 MW</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Boxes highlighted in purple denote DSM bundles that were selected by Encompass.
Clean Energy Strategy: Current Trends (Reference Case)

Retire & Replace Pete with Clean Energy

Portfolio Overview

Retirements
Petersburg:
- Pete 3 Coal: 2026
- Pete 4 Coal: 2028
  - Total Coal Retired MW: 1,040 MW

Harding Street:
- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
  - Total Retired Nat Gas MW: 618 MW

Replacements by 2042
- DSM: 610 MW
- Wind: 2,450 MW
- Solar: 2,438 MW
- Storage: 1,560 MW
- Solar + Storage: 180 MW
- Thermal: 0 MW

Current Trends PVRR Summary
20-Year PVRR (2023$MM, 2023-2042)

<table>
<thead>
<tr>
<th>Strategy</th>
<th>PVRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Early Retirement</td>
<td>$9,572</td>
</tr>
<tr>
<td>Pete Refuel to 100% Gas (est. 2025)</td>
<td>$9,330</td>
</tr>
<tr>
<td>One Pete Unit Retires (2026)</td>
<td>$9,773</td>
</tr>
<tr>
<td>Both Pete Units Retire (2026 &amp; 2028)</td>
<td>$9,618</td>
</tr>
<tr>
<td>“Clean Energy Strategy” Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
<td>$9,711</td>
</tr>
<tr>
<td>Encompass Optimization without predefined Strategy – Selects Pete 3 Refuel in 2025 &amp; Pete 4 Refuel in 2027</td>
<td>$9,262</td>
</tr>
</tbody>
</table>
**F. Encompass Optimization**

Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>No Environmental Action</th>
<th>Current Trends</th>
<th>Aggressive Environmental</th>
<th>Decarbonized Economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>$9,262</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Encompass Optimization: Current Trends (Reference Case)

Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

Firm Unforced Capacity Position – Summer

- Existing Coal
- Petersburg 3 & 4 Refuel to Natural Gas
- Existing Natural Gas
- Existing Other (Wind/Solar/DR)
- New Wind
- New Storage
- New Solar + Storage
- New Solar
- Capacity Purchases
- PRMR
- PRMR less DSM
Encompass Optimization: Current Trends (Reference Case)

Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

Firm Unforced Capacity Position – Winter

- Existing Coal
- Petersburg 3 & 4 Refuel to Natural Gas
- Existing Natural Gas
- Existing Other (Wind/Solar/DR)
- New Wind
- New Storage
- New Solar + Storage
- New Solar
- Capacity Purchases
- PRMR
- PRMR less DSM
Encompass Optimization: Current Trends (Reference Case)

Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

Installed Capacity Cumulative Additions (MW)

Installed Capacity Incremental Additions (MW): 2023 - 2028

<table>
<thead>
<tr>
<th></th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2028</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pete Refuel</td>
<td>0</td>
<td>0</td>
<td>526</td>
<td>0</td>
<td>526</td>
<td>0</td>
</tr>
<tr>
<td>Wind</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>500</td>
<td>0</td>
</tr>
<tr>
<td>Solar</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Storage</td>
<td>0</td>
<td>0</td>
<td>240</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Solar + Storage</td>
<td>0</td>
<td>0</td>
<td>45</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Encompass Optimization: Current Trends

Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

Energy Mix %

- Coal
- Natural Gas
- Wind
- Solar + Storage
- DSM

2023:
- Thermal: 49%
- Renewable/DSM: 3%
- Solar + Storage: 18%

2032:
- Thermal: 30%
- Renewable/DSM: 7%
- Solar + Storage: 46%

2042:
- Thermal: 5%
- Renewable/DSM: 8%
- Solar + Storage: 13%

Thermal MWh %:
- 2022: 92%
- 2023: 49%
- 2032: 30%
- 2042: 5%

Renewable/DSM MWh %:
- 2022: 8%
- 2023: 3%
- 2032: 7%
- 2042: 8%
## DSM Results

### Energy Efficiency:

<table>
<thead>
<tr>
<th>Vintage 1</th>
<th>Vintage 2</th>
<th>Vintage 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>2024 - 2026</td>
<td>2027 - 2029</td>
<td>2030 - 2042</td>
</tr>
<tr>
<td>Residential</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Efficient Products - Lower Cost</td>
<td>Lower Cost Residential (excluding Income Qualified Weatherization [IQW])</td>
<td>Lower Cost Residential (excluding IQW)</td>
</tr>
<tr>
<td>Efficient Products - Higher Cost</td>
<td>Higher Cost Residential (excluding IQW)</td>
<td>Higher Cost Residential (excluding IQW)</td>
</tr>
<tr>
<td>Behavioral</td>
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<td></td>
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<td></td>
</tr>
<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>IQW</td>
<td>IQW</td>
<td>IQW</td>
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<tr>
<td>C&amp;I</td>
<td>C&amp;I</td>
<td>C&amp;I</td>
</tr>
<tr>
<td>C&amp;I Prescriptive</td>
<td></td>
<td></td>
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<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>Custom RCx</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Custom SEM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avg Annual MWh</td>
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<td>Avg Annual MWh</td>
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<td>1.2%</td>
</tr>
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<td>Cumulative Summer MW</td>
</tr>
<tr>
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<td>92 MW</td>
<td>303 MW</td>
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</tbody>
</table>

### Demand Response:

<table>
<thead>
<tr>
<th>2026 - 2042</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
</tr>
<tr>
<td>Direct Load Control</td>
</tr>
<tr>
<td>C&amp;I</td>
</tr>
<tr>
<td>Direct Load Control</td>
</tr>
<tr>
<td>Cumulative Summer MW</td>
</tr>
</tbody>
</table>

**Note:** Boxes highlighted in purple denote DSM bundles that were selected by Encompass.
Encompass Optimization: Current Trends (Reference Case)

Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

Portfolio Overview

**Retirements**

- Petersburg:
  - Pete 3 Coal: 2026
  - Pete 4 Coal: 2028
  - **Total Refueled MW: 1,040 MW**

- Harding Street:
  - HS ST5 Nat Gas: 2030
  - HS ST6 Nat Gas: 2030
  - HS ST7 Nat Gas: 2033
  - **Total Nat Gas Retired MW: 618 MW**

**Replacement Additions by 2042**

- DSM: 490 MW
- Wind: 2,500 MW
- Solar: 2,145 MW
- Storage: 680 MW
- Solar + Storage: 45 MW
- Thermal: 0
- Pete 3 & 4 Refueled to Nat Gas: 1,052 MW

Current Trends PVRR Summary

<table>
<thead>
<tr>
<th>Strategy</th>
<th>PVRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Early Retirement</td>
<td>$9,572</td>
</tr>
<tr>
<td>Pete Refuel to 100% Gas (est. 2025)</td>
<td>$9,330</td>
</tr>
<tr>
<td>One Pete Unit Retires (2026)</td>
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</tr>
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<td>Both Pete Units Retire (2026 &amp; 2028)</td>
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</tr>
<tr>
<td>Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
<td>$9,711</td>
</tr>
<tr>
<td>Encompass Optimization without predefined Strategy – Selects Pete 3 Refuel in 2025 &amp; Pete 4 Refuel in 2027</td>
<td>$9,262</td>
</tr>
</tbody>
</table>
## Portfolio Matrix

### 20-Year PVRR (2023$MM, 2023-2042)

<table>
<thead>
<tr>
<th>Generation Strategies</th>
<th>Scenarios</th>
<th>No Environmental Action</th>
<th>Current Trends (Reference Case)</th>
<th>Aggressive Environmental</th>
<th>Decarbonized Economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Early Retirement</td>
<td></td>
<td>$7,111</td>
<td>$9,572</td>
<td>$11,349</td>
<td>$9,917</td>
</tr>
<tr>
<td>Pete Refuel to 100% Gas (est. 2025)</td>
<td></td>
<td>$6,621</td>
<td>$9,330</td>
<td>$11,181</td>
<td>$9,546</td>
</tr>
<tr>
<td>One Pete Unit Retires (2026)</td>
<td></td>
<td>$7,462</td>
<td>$9,773</td>
<td>$11,470</td>
<td>$9,955</td>
</tr>
<tr>
<td>Both Pete Units Retire (2026 &amp; 2028)</td>
<td></td>
<td>$7,425</td>
<td>$9,618</td>
<td>$11,145</td>
<td>$9,923</td>
</tr>
<tr>
<td>“Clean Energy Strategy” Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
<td></td>
<td>$9,211</td>
<td>$9,711</td>
<td>$11,184</td>
<td>$9,690</td>
</tr>
<tr>
<td>Encompass Optimization without predefined Strategy</td>
<td></td>
<td>$6,610</td>
<td>$9,262</td>
<td>$10,994*</td>
<td>$9,572</td>
</tr>
</tbody>
</table>

Encompass Optimization Results by Scenario:

*Refueling Pete 3 & 4 at the same time provides cost efficiencies. These efficiencies are not captured when only one unit refuels.*
## Break for Lunch

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>Speakers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afternoon Starting at 12:30 PM</td>
<td>Replacement Resource Cost Sensitivity Analysis</td>
<td>Erik Miller, Manager, Resource Planning, AES Indiana</td>
</tr>
<tr>
<td></td>
<td>Preliminary IRP Scorecard Results</td>
<td>Erik Miller, Manager, Resource Planning, AES Indiana</td>
</tr>
</tbody>
</table>
Replacement Resource Cost Sensitivity Analysis

Erik Miller, Manager, Resource Planning, AES Indiana
Replacement Resource Cost Sensitivity Analysis Overview

As part of this IRP, AES Indiana conducted a sensitivity analysis on the capital costs for replacement resources. The analysis was conducted in response to the current volatility of replacement resource capital cost caused by supply constraints and potential solar tariffs.

How the analysis was performed

→ Using secondary data sources and the responses from AES Indiana’s past two RFPs that were issued in 2020 and the spring of 2022, the IRP team created low, base and high levels of replacement resource costs.

→ Low – low costs were based on the avg of the contemporary replacement resource capital cost forecasts from Wood Mackenzie, NREL and BNEF and benchmarked against the responses from AES Indiana’s 2020 RFP.
→ Base – base costs were based on the lower half of the 2022 RFP responses.
→ High – high costs were based on the upper half of the 2022 RFP responses.
→ Capacity Expansion (Retirement & Replacement) analysis was performed for each Current Trends strategies at the three different replacement resource cost levels.

The following slides present the range of generation additions for each strategy that result from running capacity expansion with the different cost levels.

<table>
<thead>
<tr>
<th>Low, Base and High replacement resource costs (nominal $/kW unsubsidized) in 2025</th>
<th>Low</th>
<th>Base</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind</td>
<td>$1,477</td>
<td>$1,909</td>
<td>$2,340</td>
</tr>
<tr>
<td>Solar</td>
<td>$1,036</td>
<td>$1,364</td>
<td>$1,925</td>
</tr>
<tr>
<td>4-hr Storage</td>
<td>$1,016</td>
<td>$1,253</td>
<td>$1,447</td>
</tr>
<tr>
<td>6-hr Storage</td>
<td>$1,525</td>
<td>$1,880</td>
<td>$2,170</td>
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<tr>
<td>Hybrid</td>
<td>$985</td>
<td>$1,270</td>
<td>$1,689</td>
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<tr>
<td>CCGT</td>
<td>$1,028</td>
<td>$1,120</td>
<td>$1,212</td>
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<tr>
<td>Frame CT</td>
<td>$868</td>
<td>$945</td>
<td>$1,023</td>
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<tr>
<td>Aero CT</td>
<td>$1,328</td>
<td>$1,447</td>
<td>$1,566</td>
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<tr>
<td>Recip</td>
<td>$1,277</td>
<td>$1,391</td>
<td>$1,505</td>
</tr>
</tbody>
</table>
Replacement Resource Cost Sensitivity

No Early Retirement

Portfolio ICAP Retirements and Replacements by 2042

Low

Total Replacement ICAP: 5,536 MW

(1,000.00) 618 MW

Base

Total Replacement ICAP: 5,329 MW

(2,000.00) 618 MW

High

Total Replacement ICAP: 5,031 MW

(3,000.00) 618 MW

ICAP MW

0.00

1,000.00

2,000.00

3,000.00

4,000.00

5,000.00

6,000.00

7,000.00

5,536 MW

5,329 MW

5,031 MW

New Natural Gas

New Solar + Storage

New Storage

New Solar

New Wind

Existing Natural Gas

Existing Coal

AES Indiana
2022 IRP Report
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## Portfolio ICAP Retirements and Replacements by 2042

### Pete Refuel by 2025

- **Total Replacement ICAP:**
  - **6,643 MW**
  - **6,383 MW**
  - **5,936 MW**

**ICAP MW**

- **1,052**
- **2,243**
- **2,500**
- **(1,040)**
- **(618)**

**Total Retirement ICAP:**

- **1,658 MW**
- **1,658 MW**
- **1,658 MW**

**Portfolio ICAP Retirements and Replacements by 2042**

- **New Natural Gas**
- **New Solar + Storage**
- **New Storage**
- **New Solar**
- **New Wind**
- **Petersburg 3 & 4 Refuel to Natural Gas**
- **Existing Natural Gas**
- **Existing Coal**

**Total**

- **Retirement**
- **Replacement**
- **ICAP:**
- **6,643 MW**
- **6,383 MW**
- **5,936 MW**

**ICAP: 225**

**ICAP: 620**

**ICAP: 650**

**ICAP: 280**

**ICAP: 45**

**ICAP: 1,983**

**ICAP: 1,500**

**ICAP: 2,405**

**ICAP: 1,052**

**ICAP: (1,040)**

**ICAP: (618)**

**ICAP: 2,000.00**

**ICAP: 5,000.00**

**ICAP: 7,000.00**

**ICAP: 0.00**

**ICAP: (1,000.00)**

**ICAP: (2,000.00)**

**ICAP: (3,000.00)**

**ICAP: LOW**

**ICAP: BASE**

**ICAP: HIGH**

- **AES Indiana**
- **2022 IRP Report**
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Replacement Resource Cost Sensitivity

Portfolio ICAP Retirements and Replacements by 2042

One Pete Unit Retires

<table>
<thead>
<tr>
<th>Portfolio ICAP Retirements and Replacements by 2042</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Replacement ICAP:</strong></td>
</tr>
<tr>
<td>6,184 MW</td>
</tr>
<tr>
<td>6,129 MW</td>
</tr>
<tr>
<td>5,514 MW</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ICAP MW</th>
<th>Replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ICAP:</td>
</tr>
<tr>
<td></td>
<td>6,184 MW</td>
</tr>
<tr>
<td></td>
<td>6,129 MW</td>
</tr>
<tr>
<td></td>
<td>5,514 MW</td>
</tr>
</tbody>
</table>

- **New Natural Gas**
- **New Solar + Storage**
- **New Storage**
- **New Solar**
- **New Wind**
- **Existing Natural Gas**
- **Existing Coal**

<table>
<thead>
<tr>
<th>Total Retirement ICAP:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,138 MW</td>
</tr>
<tr>
<td>1,138 MW</td>
</tr>
<tr>
<td>1,138 MW</td>
</tr>
</tbody>
</table>

- **LOW**
- **BASE**
- **HIGH**
Replacement Resource Cost Sensitivity

Both Pete Unite Retire

Portfolio ICAP Retirements and Replacements by 2042

Total Replacement ICAP: 6,609 MW

LOW

- New Natural Gas
- New Solar + Storage
- New Storage
- New Solar
- New Wind
- Existing Natural Gas
- Existing Coal

Total Retirement ICAP: 1,658 MW

BASE

Total Retirement ICAP: 1,658 MW

HIGH

Total Retirement ICAP: 1,658 MW

Low

Base

High

AES Indiana
2022 IRP Report
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Replacement Resource Cost Sensitivity

Clean Energy Strategy

Portfolio ICAP Retirements and Replacements by 2042

<table>
<thead>
<tr>
<th>ICAP MW</th>
<th>Total Replacement ICAP: 6,609 MW</th>
<th>Total Retirement ICAP: 6,631 MW</th>
<th>Total Replacement ICAP: 6,319 MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOW</td>
<td>1,460</td>
<td>1,560</td>
<td>1,620</td>
</tr>
<tr>
<td>BASE</td>
<td>2,600</td>
<td>2,438</td>
<td>2,600</td>
</tr>
<tr>
<td>HIGH</td>
<td>2,500</td>
<td>2,450</td>
<td>2,050</td>
</tr>
<tr>
<td>(1,040)</td>
<td>(1,040)</td>
<td>(1,040)</td>
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<tr>
<td>(618)</td>
<td>(618)</td>
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</table>

- **New Solar + Storage**
- **New Storage**
- **New Solar**
- **New Wind**
- **Existing Natural Gas**
- **Existing Coal**
Replacement Resource Cost Sensitivity

Encompass Optimization

Portfolio ICAP Retirements and Replacements by 2042

![Diagram showing Portfolio ICAP Retirements and Replacements by 2042 with different scenarios: LOW, BASE, HIGH. The diagram includes various categories such as New Natural Gas, New Solar + Storage, New Storage, New Solar, New Wind, Existing Natural Gas, Existing Coal, and Petersburg 3 & 4 Refuel to Natural Gas. Total Replacement ICAP: 6,735 MW (LOW), 6,426 MW (BASE), 6,013 MW (HIGH).]
Replacement Resource Cost Sensitivity

Key Takeaways & PVRR Results

→ As capital costs increase, fewer renewables are built for their energy value to the portfolio.

→ As capital costs increase, newly constructed natural gas becomes more cost effective – less high price volatility with the cost to construct natural gas.

→ Across the range of Replacement Resource Costs, refueling Petersburg provides a low PVRR.

20-Year PVRR (2023$MM, 2023-2042)

<table>
<thead>
<tr>
<th>Generation Strategies</th>
<th>Current Trends (Reference Case)</th>
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<tr>
<td></td>
<td>Low</td>
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<tr>
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<td>Pete Refuel to 100% Gas (est. 2025)</td>
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<tr>
<td>One Pete Unit Retires (2026)</td>
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<td>Both Pete Units Retire (2026 &amp; 2028)</td>
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<td>&quot;Clean Energy Strategy&quot; Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
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<td>Encompass Optimization without predefined Strategy</td>
<td>$8,670*</td>
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Encompass Optimization Portfolios

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<tr>
<th>Low</th>
<th>Base</th>
<th>High</th>
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<tr>
<td>Refuels Petersburg Unit 3 in 2025*</td>
<td>Refuels Petersburg Unit 3 in 2025 &amp; Refuels Petersburg Unit 4 in 2027</td>
<td>Refuels Petersburg Unit 3 in 2025 &amp; Refuels Petersburg Unit 4 in 2027</td>
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</table>

*Refueling Pete 3 & 4 at the same time provides cost efficiencies. These efficiencies are not captured when only one unit refuels.
Preliminary IRP Scorecard Results

Erik Miller, Manager, Resource Planning, AES Indiana
Preliminary Scorecard Results

Affordability, Environmental Sustainability and Risk & Opportunity metrics for the Current Trends portfolios

<table>
<thead>
<tr>
<th>Affordability</th>
<th>20-yr PVRR</th>
<th>Environmental Sustainability</th>
<th>Reliability, Stability &amp; Resiliency</th>
<th>Risk &amp; Opportunity</th>
<th>Economic Impact</th>
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<tr>
<td>Present Value of Revenue Requirements (2023 $000,000)</td>
<td>CO₂ Emissions (mmtons) 2023 - 2032</td>
<td>SO₂ Emissions (tons) 2023 - 2032</td>
<td>NOₓ Emissions (tons) 2023 - 2032</td>
<td>Water Use (mngal) 2023 - 2032</td>
<td>CCP (tons) 2023 - 2032</td>
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<td>$9,572</td>
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<td>5</td>
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<table>
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<tr>
<th>Strategies</th>
<th>Complete Scorecard review and selection of the Preferred Resource Portfolio will be topics for Public Advisory Meeting # 5.</th>
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<tbody>
<tr>
<td>→ 1. No Early Retirement</td>
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<tr>
<td>→ 2. Pete Refuel to 100% Natural Gas (est. 2025)</td>
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<tr>
<td>→ 3. One Pete Unit Retires in 2026</td>
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<tr>
<td>→ 4. Both Pete Units Retire in 2026 &amp; 2028</td>
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<tr>
<td>→ 5. “Clean Energy Strategy” – Both Pete Units Retire and replaced with Renewables in 2026 &amp; 2028</td>
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</table>
IRP Annual Revenue Requirement

Compared to the No Retirement ("Status Quo") Scenario

Presented revenue requirement is only for incremental generation capital expenditures.

- Pete Refuel to 100% Nat Gas (est 2025)
- One Pete Unit Retires in 2026
- Both Pete Units Retire in 2026 & 2028
- "Clean Energy Strategy" – Both Pete Units Retire and Replaced with Renewables in 2026 & 2028
- Encompass Optimization w/o Predefined Strategy – Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027
Final Q&A and Next Steps
Public Advisory Meeting

All meetings will be available for attendance via Teams. Meetings in 2022 may also occur in-person.

A Technical Meeting will be held the week preceding each Public Advisory Meeting for stakeholders with nondisclosure agreements. Tech Meeting topics will focus on those anticipated at the next Public Advisory Meeting.

Thank You
No Early Retirement: Current Trends (Reference Case)
Pete 3 & 4 Refuel in 2025: Current Trends (Reference Case)
One Pete Unit Retires (2026): Current Trends (Reference Case)

Energy Mix MWh

Coal
Natural Gas
Wind
Solar + Storage
DSM
Customer Load
Both Pete Units Retire: Current Trends *(Reference Case)*

2026 & 2028

Energy Mix MWh

- Coal
- Natural Gas
- Wind
- Solar + Storage
- DSM
- Customer Load

*Reference Case*

2026 & 2028

AES Indiana
2022 IRP Report
Attachment 1-2
Page 446 of 647
Clean Energy Strategy: Current Trends *(Reference Case)*

Retire & Replace Pete with Clean Energy

Energy Mix MWh

- Coal
- Natural Gas
- Wind
- Solar + Storage
- DSM
- Customer Load
Encompass Optimization: Current Trends  (Reference Case)

Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

Energy Mix MWh
## Environmental Sustainability Metrics

| Environmental Sustainability |  
|--------------------------------|----------------------------------|
| **CO₂ Emissions**              | **SO₂ Emissions**                |
| Total portfolio CO₂ Emissions  | Total portfolio SO₂ Emissions    |
| (mmtons) 2023 - 2042           | (tons) 2023 - 2042               |
| **NOₓ Emissions**              | **Water Use**                    |
| Total portfolio NOₓ Emissions  | Water Use (mmgal)                |
| (tons) 2023 - 2042             | 2023 - 2042                      |
| **Coal Combustion Products (CCP)** |  
| CCP (tons) 2023 - 2042 | % Renewable Energy in 2032 |
| **Water Use**                  |  
| **Water Use**                  | (mmgal) 2023 - 2042              |
| ( tons) 2023 - 2042             | **Water Use**                    |
| **Clean Energy Progress**      |  
| % Renewable Energy in 2032     |  
|  

### Strategies

1. No Early Retirement
2. Pete Refuel to 100% Natural Gas (est. 2025)
3. One Pete Unit Retires in 2026
4. Both Pete Units Retire in 2026 & 2028
5. “Clean Energy Strategy” – Both Pete Units Retire and replaced with Renewables in 2026 & 2028
IRP Acronyms

Note: A glossary of acronyms with definitions is available at https://www.aesindiana.com/integrated-resource-plan.
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tr>
<td>ACEE</td>
<td>The American Council for an Energy-Efficient Economy</td>
</tr>
<tr>
<td>AMI</td>
<td>Advanced Metering Infrastructure</td>
</tr>
<tr>
<td>AD</td>
<td>Ad Valorem</td>
</tr>
<tr>
<td>AD/CVD</td>
<td>Antidumping and Countervailing Duties</td>
</tr>
<tr>
<td>ADMS</td>
<td>Advanced Distribution Management System</td>
</tr>
<tr>
<td>BESS</td>
<td>Battery Energy Storage System</td>
</tr>
<tr>
<td>BNEF</td>
<td>Bloomberg New Energy Finance</td>
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<td>BTA</td>
<td>Build-Transfer Agreement</td>
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<td>BTU</td>
<td>British Thermal Unit</td>
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<tr>
<td>C&amp;I</td>
<td>Commercial and Industrial</td>
</tr>
<tr>
<td>CAA</td>
<td>Clean Air Act</td>
</tr>
<tr>
<td>CAGR</td>
<td>Compound Annual Growth Rate</td>
</tr>
<tr>
<td>CCGT</td>
<td>Combined Cycle Gas Turbines</td>
</tr>
<tr>
<td>CCP</td>
<td>Coal Combustion Products</td>
</tr>
<tr>
<td>CCS</td>
<td>Carbon Dioxide Capture and Storage</td>
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<td>CDD</td>
<td>Cooling Degree Day</td>
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<tr>
<td>CIS</td>
<td>Customer Integrated System</td>
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<td>COD</td>
<td>Commercial Operation Date</td>
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<td>CONE</td>
<td>Cost of New Entry</td>
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<tr>
<td>CP</td>
<td>Coincident Peak</td>
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<tr>
<td>CPCN</td>
<td>Certificate of Public Convenience and Necessity</td>
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<tr>
<td>CT</td>
<td>Combustion Turbine</td>
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<td>CVD</td>
<td>Countervailing Duties</td>
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<td>CVR</td>
<td>Conservation Voltage Reduction</td>
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<td>DER</td>
<td>Distributed Energy Resource</td>
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<tr>
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<td>Distributed Energy Resource Aggregation</td>
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<td>DERMS</td>
<td>Distributed Energy Resource Management System</td>
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<td>Distributed Generation</td>
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<td>DGPV</td>
<td>Distributed Generation Photovoltaic System</td>
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<td>DLC</td>
<td>Direct Load Control</td>
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<tr>
<td>DOC</td>
<td>U.S. Department of Commerce</td>
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<tr>
<td>DOE</td>
<td>U.S. Department of Energy</td>
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<td>DR</td>
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<td>Demand Response Resource</td>
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<td>Demand-Side Management</td>
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<td>EE</td>
<td>Energy Efficiency</td>
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<td>EFORd</td>
<td>Equivalent Forced Outage Rate Demand</td>
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<td>Energy Information Administration</td>
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<td>ELCC</td>
<td>Effective Load Carrying Capability</td>
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<td>EM&amp;V</td>
<td>Evaluation Measurement and Verification</td>
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<td>ESCR</td>
<td>Effective Selective Catalytic Reduction System</td>
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<tr>
<td>EV</td>
<td>Electric Vehicle</td>
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<td>FLOC</td>
<td>Federated Learning of Cohorts</td>
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<td>Full-Time Employee</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>Geographic Information System</td>
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<td>Gas Turbine</td>
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<td>Heating, Ventilation, and Air Conditioning</td>
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<td>Indiana Administrative Code</td>
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<td>Inverter-Based Resource</td>
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<td>IC</td>
<td>Indiana Code</td>
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<td>ICE</td>
<td>Intercontinental Exchange</td>
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<td>ICAP</td>
<td>Installed Capacity</td>
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<td>IEEE</td>
<td>Institute of Electrical and Electronics Engineers</td>
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## IRP Acronyms

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<th>Acronym</th>
<th>Description</th>
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<td>IRA</td>
<td>Inflation Reduction Act</td>
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<td>IRP</td>
<td>Integrated Resource Plan</td>
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<td>ICE</td>
<td>Internal Combustion Engine</td>
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<td>IQW</td>
<td>Income Qualified Weatherization</td>
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<td>ITC</td>
<td>Investment Tax Credit</td>
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<td>IURC</td>
<td>Indiana Regulatory Commission</td>
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<td>kW</td>
<td>Kilowatt</td>
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<td>kWh</td>
<td>Kilowatt-Hour</td>
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<td>Mercury and Air Toxics Standards</td>
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<td>MaxGen</td>
<td>Maximum Generation</td>
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<td>MDMS</td>
<td>Meter Data Management System</td>
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<td>MISO</td>
<td>Midcontinent Independent System Operator</td>
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<tr>
<td>MMGAL</td>
<td>One Million Gallons</td>
</tr>
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<td>MMTons</td>
<td>One Million Metric Tons</td>
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<td>Net Present Value</td>
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<td>PRA</td>
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<td>Resource Availability and Need</td>
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<td>MISO’s Renewable Integration Impact Assessment</td>
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<td>Renewable Portfolio Standard</td>
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<td>SCADA</td>
<td>Supervisory Control and Data Acquisition</td>
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<td>RTO</td>
<td>Regional Transmission Organization</td>
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<td>SAC</td>
<td>MISO’s Seasonal Accredited Capacity</td>
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<td>Small Area Estimation</td>
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<td>Selective Catalytic Reduction System</td>
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<td>Strategic Energy Management</td>
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<td>SO2</td>
<td>Sulfur Dioxide</td>
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<tr>
<td>SMR</td>
<td>Small Modular Reactors</td>
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<td>Steam Turbine</td>
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<td>SUFG</td>
<td>State Utility Forecasting Group</td>
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<td>Transmission and Distribution</td>
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<td>TOU</td>
<td>Time-of-Use</td>
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<td>Unforced Capacity</td>
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<td>Volt-Amp Reactive</td>
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<td>Virtual Private Network</td>
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<td>WTP</td>
<td>Willingness to Participate</td>
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<td>XEFORd</td>
<td>Equivalent Forced Outage Rate Demand excluding causes of outages that are outside management control</td>
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## No Environmental Action

**20-Year PVRR (2023$MM, 2023-2042)**

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<tr>
<th>Generation Strategies</th>
<th>Scenarios</th>
<th>Cost</th>
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<td>No Early Retirement</td>
<td>No Environmental Action</td>
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<tr>
<td>Pete Refuel to 100% Gas (est. 2025)</td>
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<td>$7,425</td>
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<td>$9,211</td>
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<tr>
<td>Encompass Optimization without predefined Strategy – Selects Pete 3 &amp; 4 Refuel in 2025</td>
<td></td>
<td>$6,610</td>
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## A. No Early Retirement

### Generation Strategy:
- **No Early Retirement**

<table>
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<tr>
<th>Scenarios</th>
<th>No Environmental Action</th>
<th>Current Trends</th>
<th>Aggressive Environmental</th>
<th>Decarbonized Economy</th>
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<td><strong>$7,111</strong></td>
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<td></td>
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<td></td>
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</tbody>
</table>
No Early Retirement: No Environmental Action

Firm Unforced Capacity Position – Summer

- Existing Coal
- Existing Natural Gas
- Existing Other (Wind/Solar/DR)
- Petersburg 3 & 4 Refuel to Natural Gas
- New Wind
- New Solar
- New Storage
- New Solar + Storage
- New Natural Gas
- Capacity Purchases
- PRMR
- PRMR less DSM
No Early Retirement: No Environmental Action

Firm Unforced Capacity Position – Winter

- Existing Coal
- Existing Natural Gas
- Existing Other (Wind/Solar/DR)
- Petersburg 3 & 4 Refuel to Natural Gas
- New Wind
- New Solar
- New Storage
- New Solar + Storage
- New Natural Gas
- Capacity Purchases
- PRMR
- PRMR less DSM
### Installed Capacity Incremental Additions (MW): 2023 - 2028

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<tr>
<th>Source</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2028</th>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>Storage</td>
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<td>180</td>
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<td>Solar + Storage</td>
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<td>0</td>
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<td>0</td>
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<td>Gas</td>
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<td>0</td>
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<td>0</td>
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<td>0</td>
</tr>
</tbody>
</table>

No Early Retirement: No Environmental Action
No Early Retirement: No Environmental Action

### Current Trends PVRR Summary
20-Year PVRR (2023$MM, 2023-2042)

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>2023$MM</th>
</tr>
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<td>No Environmental Action</td>
<td>$7,111</td>
</tr>
<tr>
<td>No Early Retirement</td>
<td>$7,111</td>
</tr>
<tr>
<td>Pete Refuel to 100% Gas (est. 2025)</td>
<td>$6,621</td>
</tr>
<tr>
<td>One Pete Unit Retires (2026)</td>
<td>$7,462</td>
</tr>
<tr>
<td>Both Pete Units Retire (2026 &amp; 2028)</td>
<td>$7,425</td>
</tr>
<tr>
<td>&quot;Clean Energy Strategy&quot;</td>
<td>$9,211</td>
</tr>
<tr>
<td>Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
<td>$9,211</td>
</tr>
<tr>
<td>Encompass Optimization without predefined Strategy</td>
<td>$6,610</td>
</tr>
</tbody>
</table>
### B. Pete Refuel by 2025

**Generation Strategy:**
*Pete Refuel to 100% Gas (est. 2025)*

#### 20-Year PVRR (2023$MM, 2023-2042)

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>No Environmental Action</th>
<th>Current Trends</th>
<th>Aggressive Environmental</th>
<th>Decarbonized Economy</th>
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</thead>
<tbody>
<tr>
<td><strong>$6,621</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
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2022 IRP Report
Attachment 1-2
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Pete 3 & 4 Refuel in 2025: No Environmental Action
Pete 3 & 4 Refuel in 2025: No Environmental Action
Pete 3 & 4 Refuel in 2025: No Environmental Action

Installed Capacity Incremental Additions (MW): 2023 - 2028

<table>
<thead>
<tr>
<th></th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2028</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Solar</td>
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<td>0</td>
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<td>0</td>
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<tr>
<td>Storage</td>
<td>0</td>
<td>0</td>
<td>180</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Solar + Storage</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pete Refuel</td>
<td>0</td>
<td>0</td>
<td>1,052</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Gas</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
# Portfolio Overview

## Retirements

**Petersburg:**
- Pete 3 & 4 Coal: 2025 Refuel with Nat Gas
- **Total Refueled MW: 1,040 MW**

**Harding Street:**
- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
- **Total Nat Gas Retired MW: 618 MW**

## Replacement Additions by 2042

- DSM: 326 MW
- Wind: 0 MW
- Solar: 0 MW
- Storage: 260 MW
- Solar + Storage: 0 MW
- Thermal: 750 MW
- Pete 3 & 4 Refueled to Nat Gas: 1,052 MW

## Current Trends PVRR Summary

**20-Year PVRR (2023$MM, 2023-2042)**

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>Cost ($MM)</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
</tr>
<tr>
<td>No Early Retirement</td>
<td>$7,111</td>
</tr>
<tr>
<td>Pete Refuel to 100% Gas (est. 2025)</td>
<td>$6,621</td>
</tr>
<tr>
<td>One Pete Unit Retires (2026)</td>
<td>$7,462</td>
</tr>
<tr>
<td>Both Pete Units Retire (2026 &amp; 2028)</td>
<td>$7,425</td>
</tr>
<tr>
<td>&quot;Clean Energy Strategy&quot;</td>
<td>$9,211</td>
</tr>
<tr>
<td>Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
<td></td>
</tr>
<tr>
<td>Encompass Optimization without predefined Strategy</td>
<td>$6,610</td>
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</table>
## C. One Pete Unit Retires (2026)

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>No Environmental Action</th>
<th>Current Trends</th>
<th>Aggressive Environmental</th>
<th>Decarbonized Economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-Year PVRR</td>
<td>$7,462</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(2023$MM, 2023-2042)</td>
<td></td>
<td></td>
<td></td>
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**Generation Strategy:**
One Pete Unit Retires (2026)
One Pete Unit Retires (2026): No Environmental Action
One Pete Unit Retires (2026): No Environmental Action
One Pete Unit Retires (2026): No Environmental Action

**Installed Capacity Incremental Additions (MW): 2023 - 2028**

<table>
<thead>
<tr>
<th></th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2028</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tr>
<tr>
<td>Solar</td>
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<td>Storage</td>
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<td>0</td>
<td>220</td>
<td>400</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Solar + Storage</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pete Refuel</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Gas</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tbody>
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Energy Mix %

<table>
<thead>
<tr>
<th>Year</th>
<th>Coal</th>
<th>Natural Gas</th>
<th>Wind</th>
<th>Solar + Storage</th>
<th>DSM</th>
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</thead>
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<tr>
<td>2023</td>
<td>44%</td>
<td>48%</td>
<td>5%</td>
<td>1%</td>
<td>3%</td>
</tr>
<tr>
<td>2025</td>
<td>62%</td>
<td>37%</td>
<td>5%</td>
<td>2%</td>
<td>3%</td>
</tr>
<tr>
<td>2028</td>
<td>65%</td>
<td>35%</td>
<td>5%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>2032</td>
<td>70%</td>
<td>30%</td>
<td>5%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>2042</td>
<td>73%</td>
<td>27%</td>
<td>5%</td>
<td>3%</td>
<td>3%</td>
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</tbody>
</table>

The table above shows the energy mix percentages for different years, with coal being the primary energy source, followed by natural gas, wind, solar + storage, and DSM. The percentages have been consistent over the years, with a slight increase in wind and solar + storage. Additionally, the graph shows the energy mix percentages for each year, with a significant decrease in coal usage and an increase in renewable energy sources.
One Pete Unit Retires (2026): No Environmental Action

**Portfolio Overview**

**Retirements**
- Petersburg:
  - Pete 3 Coal: 2026
  - Total Coal Retired MW: 520 MW

- Harding Street:
  - HS ST5 Nat Gas: 2030
  - HS ST6 Nat Gas: 2030
  - HS ST7 Nat Gas: 2033
  - Total Nat Gas Retired MW: 618 MW

**Replacement Additions by 2042**
- DSM: 453 MW
- Wind: 0 MW
- Solar: 0 MW
- Storage: 640 MW
- Solar + Storage: 0 MW
- Thermal: 650 MW

**Current Trends PVRR Summary**

20-Year PVRR (2023$MM, 2023-2042)

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Environmental Action</td>
<td>$7,111</td>
</tr>
<tr>
<td>No Early Retirement</td>
<td>$6,621</td>
</tr>
<tr>
<td>Pete Refuel to 100% Gas (est. 2025)</td>
<td></td>
</tr>
<tr>
<td>One Pete Unit Retires (2026)</td>
<td>$7,462</td>
</tr>
<tr>
<td>Both Pete Units Retire (2026 &amp; 2028)</td>
<td>$7,425</td>
</tr>
<tr>
<td>&quot;Clean Energy Strategy&quot;</td>
<td>$9,211</td>
</tr>
<tr>
<td>Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
<td></td>
</tr>
<tr>
<td>Encompass Optimization without predefined Strategy</td>
<td>$6,610</td>
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</table>
## D. Both Pete Units Retire (2026 & 2028)

### 20-Year PVRR (2023$MM, 2023-2042)

**Generation Strategy:**
*Both Pete Units Retire (2026 & 2028)*

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>No Environmental Action</th>
<th>Current Trends</th>
<th>Aggressive Environmental</th>
<th>Decarbonized Economy</th>
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<td>$7,425</td>
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</tr>
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</table>

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2022 IRP Report
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Both Pete Units Retire: No Environmental Action

2026 & 2028

Firm Unforced Capacity Position - Summer

- Existing Coal
- New Wind
- Existing Natural Gas
- New Solar
- Existing Other (Wind/Solar/DR)
- New Natural Gas
- Capacity Purchases
- Petersburg 3 & 4 Refuel to Natural Gas
- PRMR
- PRMR less DSM
- New Solar + Storage
Both Pete Units Retire: No Environmental Action

2026 & 2028

Firm Unforced Capacity Position - Winter

UCAP MW

- Existing Coal
- New Wind
- New Natural Gas
- Existing Natural Gas
- New Solar
- Existing Other (Wind/Solar/DR)
- Petersburg 3 & 4 Refuel to Natural Gas
- New Solar + Storage
- Capacity Purchases
- PRMR
- PRMR less DSM

AES Indiana
2022 IRP Report
Attachment 1-2
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Both Pete Units Retire: No Environmental Action

2026 & 2028

Installed Capacity Incremental Additions (MW): 2023 – 2028

<table>
<thead>
<tr>
<th></th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2028</th>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>Storage</td>
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<td>220</td>
<td>460</td>
<td>0</td>
<td>80</td>
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<tr>
<td>Solar + Storage</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pete Refuel</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>Gas</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>325</td>
</tr>
</tbody>
</table>
2026 & 2028

Energy Mix %

- Coal
- Natural Gas
- Wind
- Solar + Storage
- DSM

<table>
<thead>
<tr>
<th>Year</th>
<th>Thermal MWh %</th>
<th>Renewable/DSM MWh %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2023</td>
<td>92%</td>
<td>8%</td>
</tr>
<tr>
<td>2025</td>
<td>85%</td>
<td>14%</td>
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<td>2028</td>
<td>84%</td>
<td>16%</td>
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<tr>
<td>2032</td>
<td>85%</td>
<td>14%</td>
</tr>
<tr>
<td>2042</td>
<td>85%</td>
<td>15%</td>
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</tbody>
</table>
Portfolios Overview

**Retirements**

- Petersburg:
  - Pete 3 Coal: 2026
  - Pete 4 Coal: 2028
  - Total Coal Retired MW: 1,040 MW

- Harding Street:
  - HS ST5 Nat Gas: 2030
  - HS ST6 Nat Gas: 2030
  - HS ST7 Nat Gas: 2033
  - Total Nat Gas Retired MW: 618 MW

**Replacement Additions by 2042**

- DSM: 472 MW
- Wind: 0 MW
- Solar: 0 MW
- Storage: 860 MW
- Solar + Storage: MW
- Thermal: 975 MW

---

**Current Trends PVRR Summary**

20-Year PVRR (2023$MM, 2023-2042)

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>Cost</th>
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<td></td>
</tr>
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<td>$7,111</td>
</tr>
<tr>
<td>Pete Refuel to 100% Gas (est. 2025)</td>
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</tr>
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</tr>
<tr>
<td>Both Pete Units Retire (2026 &amp; 2028)</td>
<td>$7,425</td>
</tr>
<tr>
<td>&quot;Clean Energy Strategy&quot;</td>
<td></td>
</tr>
<tr>
<td>Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
<td>$9,211</td>
</tr>
<tr>
<td>Encompass Optimization without predefined Strategy</td>
<td>$6,610</td>
</tr>
</tbody>
</table>

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Retire & Replace Pete with Clean Energy

20-Year PVRR (2023$MM, 2023-2042)

Generation Strategy: 
"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>No Environmental Action</th>
<th>Current Trends</th>
<th>Aggressive Environmental</th>
<th>Decarbonized Economy</th>
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<tbody>
<tr>
<td>$9,211</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Clean Energy Strategy: No Environmental Action

Retire & Replace Pete with Clean Energy

Firm Unforced Capacity Position – Summer

- Existing Coal
- Existing Natural Gas
- Existing Other (Wind/Solar/DR)
- Petersburg 3 & 4 Refuel to Natural Gas
- New Wind
- New Solar
- New Storage
- New Solar + Storage
- New Natural Gas
- Capacity Purchases
- PRMR
- PRMR less DSM
Clean Energy Strategy: Decarbonized Economy

Retire & Replace Pete with Clean Energy

Firm Unforced Capacity Position – Winter

- Existing Coal
- Existing Natural Gas
- Existing Other (Wind/Solar/DR)
- Petersburg 3 & 4 Refuel to Natural Gas
- New Wind
- New Solar
- New Storage
- New Solar + Storage
- Capacity Purchases
- PRMR
- PRMR less DSM

UCAP MW

2022 IRP
Clean Energy Strategy: Decarbonized Economy

Retire & Replace Pete with Clean Energy

Installed Capacity Incremental Additions (MW): 2023 – 2028

<table>
<thead>
<tr>
<th></th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2028</th>
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<tbody>
<tr>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
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<td>0</td>
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<td>0</td>
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<tr>
<td>Storage</td>
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<td>0</td>
<td>220</td>
<td>420</td>
<td>0</td>
<td>420</td>
</tr>
<tr>
<td>Solar + Storage</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pete Refuel</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Gas</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Clean Energy Strategy: Decarbonized Economy

Energy Mix %

- Coal
- Natural Gas
- Wind
- Solar + Storage
- DSM

Energy Mix for years 2023 to 2042:

<table>
<thead>
<tr>
<th>Year</th>
<th>Coal (%)</th>
<th>Natural Gas (%)</th>
<th>Wind (%)</th>
<th>Solar + Storage (%)</th>
<th>DSM (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2023</td>
<td>63%</td>
<td>5%</td>
<td>5%</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>2025</td>
<td>61%</td>
<td>5%</td>
<td>7%</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>2028</td>
<td>60%</td>
<td>6%</td>
<td>8%</td>
<td>5%</td>
<td>3%</td>
</tr>
<tr>
<td>2032</td>
<td>77%</td>
<td>8%</td>
<td>5%</td>
<td>2%</td>
<td>3%</td>
</tr>
<tr>
<td>2042</td>
<td>97%</td>
<td>4%</td>
<td>4%</td>
<td>3%</td>
<td>3%</td>
</tr>
</tbody>
</table>

*Clean Energy Strategy: Decarbonized Economy*
Portfolio Overview

Retirements

Petersburg:
- Pete 3 Coal: 2026
- Pete 4 Coal: 2028
- **Total Coal Retired MW: 1,040 MW**

Harding Street:
- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
- **Total Retired Nat Gas MW: 618 MW**

Replacements by 2042

- DSM: 610 MW
- Wind: 100 MW
- Solar: 2,600 MW
- Storage: 1,680 MW
- Solar + Storage: 45 MW
- Thermal: 0 MW

Current Trends PVRR Summary
20-Year PVRR (2023$MM, 2023-2042)

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Early Retirement</td>
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<td>$7,425</td>
</tr>
</tbody>
</table>
| "Clean Energy Strategy"
  Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028) | **$9,211** |
| Encompass Optimization without predefined Strategy            | $6,610|
### F. Encompass Optimization

**Refuels Petersburg Units 3 & 4 in 2025**

#### Generation Strategy:
*Encompass Optimization without predefined Strategy – Selects Pete 3 & 4 Refuel in 2025*

<table>
<thead>
<tr>
<th>20-Year PVRR (2023$MM, 2023-2042)</th>
<th>Scenarios</th>
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<tbody>
<tr>
<td><strong>No Environmental Action</strong></td>
<td><strong>Current Trends</strong></td>
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<td>$6,610</td>
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Encompass Optimization: No Environmental Action

Refuels Petersburg Units 3 & 4 in 2025

Firm Unforced Capacity Position - Summer

- Existing Coal
- New Wind
- New Natural Gas
- New Solar
- New Solar + Storage
- Existing Natural Gas
- Existing Other (Wind/Solar/DR)
- Petersburgh 3 & 4 Refuel to Natural Gas
- PRMR
- PRMR less DSM

UCAP MW

0 500 1,000 1,500 2,000 2,500 3,000 3,500 4,000

2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042

2022 IRP
Encompass Optimization: No Environmental Action

Refuels Petersburg Units 3 & 4 in 2025

Firm Unforced Capacity Position - Winter

- Existing Coal
- Existing Natural Gas
- Existing Other (Wind/Solar/DR)
- Petersburg 3 & 4 Refuel to Natural Gas
- New Wind
- New Solar
- New Storage
- New Solar + Storage
- Capacity Purchases
- PRMR
- PRMR less DSM

UCAP MW
Encompass Optimization: No Environmental Action

Refuels Petersburg Units 3 & 4 in 2025

Installed Capacity Incremental Additions (MW): 2023 - 2028

<table>
<thead>
<tr>
<th></th>
<th>2023</th>
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</table>
Refuels Petersburg Units 3 & 4 in 2025

Energy Mix %

- Coal
- Natural Gas
- Wind
- Solar + Storage
- DSM

2022 IRP Report
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Encompass Optimization: No Environmental Action

Refuels Petersburg Units 3 & 4 in 2025

Portfolio Overview

Retirements

Petersburg:
- Pete 3 Coal: 2025
- Pete 4 Coal: 2025
  → Total Refueled MW: 1,040 MW

Harding Street:
- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
  → Total Nat Gas Retired MW: 618 MW

Replacement Additions by 2042

- DSM: 326 MW
- Wind: 0 MW
- Solar: 0 MW
- Storage: 280 MW
- Solar + Storage: 45 MW
- Thermal: 650 MW
- Pete 3 & 4 Refueled to Nat Gas: 1,052 MW

Current Trends PVRR Summary

20-Year PVRR (2023$MM, 2023-2042)

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<thead>
<tr>
<th>Scenarios</th>
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<tr>
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<td>$6,610</td>
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## Portfolio Matrix

### 20-Year PVRR (2023$MM, 2023-2042)

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<th>Scenarios</th>
<th>No Environmental Action</th>
<th>Current Trends (Reference Case)</th>
<th>Aggressive Environmental</th>
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### Encompass Optimization Results by Scenario:

- Refuels Petersburg Unit 3 in 2025 & Refuels Petersburg Unit 4 in 2027
- Refuels Petersburg Unit 4 in 2027
- Refuels Petersburg Unit 3 in 2025 & Refuels Petersburg Unit 4 in 2027
## Decarbonized Economy

### Generation Strategies

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<th>Scenarios</th>
<th>20-Year PVRR (2023$MM, 2023-2042)</th>
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<td>No Early Retirement</td>
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<td>Pete Refuel to 100% Gas (est. 2025)</td>
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<tr>
<td>One Pete Unit Retires (2026)</td>
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<tr>
<td>Both Pete Units Retire (2026 &amp; 2028)</td>
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</tr>
<tr>
<td>“Clean Energy Strategy” Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
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<td>Encompass Optimization without predefined Strategy – Selects Pete 3 Refuel in 2025 &amp; Pete 4 Refuel in 2027</td>
<td>$9,572</td>
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## A. No Early Retirement

### Generation Strategy: No Early Retirement

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<tr>
<th>Scenarios</th>
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<th>Current Trends</th>
<th>Aggressive Environmental</th>
<th>Decarbonized Economy</th>
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<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
<td>$9,917</td>
</tr>
</tbody>
</table>
No Early Retirement: Decarbonized Economy

Firm Unforced Capacity Position – Summer

- Existing Coal
- Existing Natural Gas
- Existing Other (Wind/Solar/DR)
- Petersburg 3 & 4 Refuel to Natural Gas
- New Wind
- New Solar
- New Storage
- New Solar + Storage
- New Natural Gas
- Capacity Purchases
- PRMR
- PRMR less DSM
No Early Retirement: Decarbonized Economy

Firm Unforced Capacity Position – Winter
No Early Retirement: Decarbonized Economy

Installed Capacity Cumulative Additions (MW)

Installed Capacity Incremental Additions (MW): 2023 - 2028

<table>
<thead>
<tr>
<th></th>
<th>2023</th>
<th>2024</th>
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<th>2027</th>
<th>2028</th>
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<td>0</td>
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<tr>
<td>Solar + Storage</td>
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<td>45</td>
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<td>0</td>
<td>0</td>
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<td>0</td>
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</table>
No Early Retirement: Decarbonized Economy

Energy Mix %

- Coal
- Natural Gas
- Wind
- Solar + Storage
- DSM

- 2023: 6% Coal, 47% Natural Gas, 3% Wind, 12% Solar + Storage, 8% DSM
- 2025: 6% Coal, 47% Natural Gas, 7% Wind, 12% Solar + Storage, 8% DSM
- 2028: 6% Coal, 47% Natural Gas, 11% Wind, 12% Solar + Storage, 8% DSM
- 2032: 6% Coal, 47% Natural Gas, 14% Wind, 12% Solar + Storage, 8% DSM
- 2042: 6% Coal, 47% Natural Gas, 17% Wind, 12% Solar + Storage, 8% DSM

Thermal MWh %
- 2023: 92%
- 2025: 90%
- 2028: 85%
- 2032: 80%
- 2042: 75%

Renewable/DSM MWh %
- 2023: 8%
- 2025: 10%
- 2028: 15%
- 2032: 20%
- 2042: 25%
No Early Retirement: Decarbonized Economy

Portfolio Overview

Retirements

Harding Street:
- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
- Total Nat Gas Retired MW: 618 MW

Replacement Additions by 2042

- DSM: 490 MW
- Wind: 2,350 MW
- Solar: 2,600 MW
- Storage: 900 MW
- Solar + Storage: 45 MW
- Thermal: 0 MW

Current Trends PVRR Summary

20-Year PVRR (2023$MM, 2023-2042)

<table>
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<td>Pete Refuel to 100% Gas (est. 2025)</td>
<td>$9,546</td>
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<tr>
<td>One Pete Unit Retires (2026)</td>
<td>$9,955</td>
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<tr>
<td>Both Pete Units Retire (2026 &amp; 2028)</td>
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<tr>
<td>&quot;Clean Energy Strategy&quot; Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
<td>$9,690</td>
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<tr>
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<td>$9,572</td>
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</table>
# B. Pete Refuel by 2025

20-Year PVRR (2023$MM, 2023-2042)

## Generation Strategy:
Pete Refuel to 100% Gas (est. 2025)

<table>
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<tr>
<th>Scenarios</th>
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<th>Current Trends</th>
<th>Aggressive Environmental</th>
<th>Decarbonized Economy</th>
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<tbody>
<tr>
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<td></td>
<td></td>
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</table>
Pete 3 & 4 Refuel in 2025: Decarbonized Economy

Firm Unforced Capacity Position – Summer

- Existing Coal
- New Wind
- New Natural Gas
- Existing Natural Gas
- New Solar
- Existing Other (Wind/Solar/DR)
- Petersburg 3 & 4 Refuel to Natural Gas
- New Solar + Storage
- Capacity Purchases
- PRMR
- PRMR less DSM

UCAP MW

2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042
Firm Unforced Capacity Position – Winter

2022 IRP

AES Indiana
2022 IRP Report
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Pete 3 & 4 Refuel in 2025: Decarbonized Economy

Installed Capacity Cumulative Additions (MW)

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<td>2027</td>
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<td>2028</td>
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## Installed Capacity Incremental Additions (MW): 2023 - 2028

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<td>Storage</td>
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<td>0</td>
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<td>Solar + Storage</td>
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<td>Gas</td>
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<td>0</td>
<td>0</td>
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</table>
Pete 3 & 4 Refuel in 2025: Decarbonized Economy

Energy Mix %

Coal  | Natural Gas  | Wind  | Solar + Storage | DSM

2023  | 5%  | 47%  | 14%  | 2%  | 1%  |
2024  | 2%  | 45%  | 5%   | 14% | 2%  |
2025  | 2%  | 39%  | 5%   | 14% | 2%  |
2026  | 2%  | 35%  | 5%   | 14% | 2%  |
2027  | 2%  | 31%  | 5%   | 14% | 2%  |
2028  | 2%  | 27%  | 5%   | 14% | 2%  |
2029  | 2%  | 23%  | 5%   | 14% | 2%  |
2030  | 2%  | 19%  | 5%   | 14% | 2%  |
2031  | 2%  | 15%  | 5%   | 14% | 2%  |
2032  | 2%  | 11%  | 5%   | 14% | 2%  |
2033  | 2%  | 7%   | 5%   | 14% | 2%  |
2034  | 2%  | 3%   | 5%   | 14% | 2%  |
2035  | 2%  | 1%   | 5%   | 14% | 2%  |
2036  | 2%  | 1%   | 5%   | 14% | 2%  |
2037  | 2%  | 1%   | 5%   | 14% | 2%  |
2038  | 2%  | 1%   | 5%   | 14% | 2%  |
2039  | 2%  | 1%   | 5%   | 14% | 2%  |
2040  | 2%  | 1%   | 5%   | 14% | 2%  |
2041  | 2%  | 1%   | 5%   | 14% | 2%  |
2042  | 2%  | 1%   | 5%   | 14% | 2%  |

Thermal MWh %  | 92%  | 79%  | 63%  | 46%  | 14%
Renewable/DSM MWh %  | 8%   | 21%  | 37%  | 54%  | 86%
Pete 3 & 4 Refuel in 2025: Decarbonized Economy

Portfolio Overview

Retirements

Petersburg:
→ Pete 3 & 4 Coal: 2025 Refuel with Nat Gas
 → Total Refueled MW: 1,040 MW

Harding Street:
→ HS ST5 Nat Gas: 2030
→ HS ST6 Nat Gas: 2030
→ HS ST7 Nat Gas: 2033
 → Total Nat Gas Retired MW: 618 MW

Replacement Additions by 2042

→ DSM: 490 MW
→ Wind: 2,350 MW
→ Solar: 2,600 MW
→ Storage: 900 MW
→ Solar + Storage: 45 MW
→ Thermal: 0
→ Pete 3 & 4 Refueled to Nat Gas: 1,052 MW

Current Trends PVRR Summary

20-Year PVRR (2023$MM, 2023-2042)

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>Value</th>
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<td>Pete Refuel to 100% Gas (est. 2025)</td>
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<tr>
<td>One Pete Unit Retires (2026)</td>
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<tr>
<td>Both Pete Units Retire (2026 &amp; 2028)</td>
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<td>$9,690</td>
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<tr>
<td>Encompass Optimization without predefined Strategy</td>
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## C. One Pete Unit Retires (2026)

### 20-Year PVRR (2023$MM, 2023-2042)

**Generation Strategy:**
*One Pete Unit Retires (2026)*

<table>
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<tr>
<th>Scenarios</th>
<th>No Environmental Action</th>
<th>Current Trends</th>
<th>Aggressive Environmental</th>
<th>Decarbonized Economy</th>
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<td>$9,955</td>
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</table>
One Pete Unit Retires (2026): Decarbonized Economy

Firm Unforced Capacity Position - Summer

- Existing Coal
- Existing Natural Gas
- Existing Other (Wind/Solar/DR)
- Petersburg 3 & 4 Refuel to Natural Gas
- New Wind
- New Solar
- New Storage
- New Solar + Storage
- New Natural Gas
- PRMR
- PRMR less DSM

UCAP MW
One Pete Unit Retires (2026): Decarbonized Economy

Firm Unforced Capacity Position - Winter
One Pete Unit Retires (2026): Decarbonized Economy

Installed Capacity Cumulative Additions (MW)

Installed Capacity Incremental Additions (MW): 2023 - 2028

<table>
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<tr>
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<th>2023</th>
<th>2024</th>
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<th>2026</th>
<th>2027</th>
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One Pete Unit Retires (2026): Decarbonized Economy

Energy Mix %

- Coal
- Natural Gas
- Wind
- Solar + Storage
- DSM

Yearly Energy Mix:
- 2023: 47% Coal, 5% Natural Gas, 5% Wind, 5% Solar + Storage, 45% DSM
- 2025: 47% Coal, 12% Natural Gas, 5% Wind, 5% Solar + Storage, 45% DSM
- 2028: 47% Coal, 13% Natural Gas, 4% Wind, 5% Solar + Storage, 45% DSM
- 2032: 47% Coal, 15% Natural Gas, 6% Wind, 5% Solar + Storage, 45% DSM
- 2042: 47% Coal, 13% Natural Gas, 11% Wind, 5% Solar + Storage, 45% DSM
One Pete Unit Retires (2026): Decarbonized Economy

Portfolio Overview

Retirements
Petersburg:
→ Pete 3 Coal: 2026
→ Total Coal Retired MW: 520 MW

Harding Street:
→ HS ST5 Nat Gas: 2030
→ HS ST6 Nat Gas: 2030
→ HS ST7 Nat Gas: 2033
→ Total Nat Gas Retired MW: 618 MW

Replacement Additions by 2042
→ DSM: 610 MW
→ Wind: 2,300 MW
→ Solar: 2,600 MW
→ Storage: 1,260 MW
→ Solar + Storage: 45 MW
→ Thermal: 0 MW

Current Trends PVRR Summary
20-Year PVRR (2023$MM, 2023-2042)

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<thead>
<tr>
<th>Scenarios</th>
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<td>Encompass Optimization without predefined Strategy</td>
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### D. Both Pete Units Retire (2026 & 2028)

**20-Year PVRR (2023$MM, 2023-2042)**

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Both Pete Units Retire: Decarbonized Economy

2026 & 2028

Firm Unforced Capacity Position – Winter

- Existing Coal
- Existing Natural Gas
- Existing Other (Wind/Solar/DR)
- Petersburg 3 & 4 Refuel to Natural Gas
- New Wind
- New Solar
- New Storage
- New Natural Gas
- Capacity Purchases
- PRMR
- PRMR less DSM

UCAP MW

2022 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042

0 500 1,000 1,500 2,000 2,500 3,000 3,500 4,000
Both Pete Units Retire: Decarbonized Economy

Installed Capacity Cumulative Additions (MW)

<table>
<thead>
<tr>
<th>Year</th>
<th>Wind</th>
<th>Solar</th>
<th>Storage</th>
<th>Solar + Storage</th>
<th>Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>2023</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>2024</td>
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<td>0</td>
<td>260</td>
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<td>2025</td>
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Installed Capacity Incremental Additions (MW): 2023 – 2028
Both Pete Units Retire: Decarbonized Economy

2026 & 2028

Energy Mix %

Coal | Natural Gas | Wind | Solar + Storage | DSM

2022 IRP Report
Attachment 1-2
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Both Pete Units Retire: Decarbonized Economy 2026 & 2028

Portfolio Overview

Retirements
- Petersburg:
  - Pete 3 Coal: 2026
  - Pete 4 Coal: 2028
    - Total Coal Retired MW: 1,040 MW
- Harding Street:
  - HS ST5 Nat Gas: 2030
  - HS ST6 Nat Gas: 2030
  - HS ST7 Nat Gas: 2033
    - Total Nat Gas Retired MW: 618 MW

Replacement Additions by 2042
- DSM: 610 MW
- Wind: 2,300 MW
- Solar: 2,600 MW
- Storage: 1,480 MW
- Solar + Storage: 45 MW
- Thermal: 325 MW

Current Trends PVRR Summary
20-Year PVRR (2023$MM, 2023-2042)

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>Cost (2023$MM)</th>
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<tbody>
<tr>
<td>No Early Retirement</td>
<td>$9,917</td>
</tr>
<tr>
<td>Pete Refuel to 100% Gas (est. 2025)</td>
<td>$9,546</td>
</tr>
<tr>
<td>One Pete Unit Retires (2026)</td>
<td>$9,955</td>
</tr>
<tr>
<td>Both Pete Units Retire (2026 &amp; 2028)</td>
<td>$9,923</td>
</tr>
<tr>
<td>&quot;Clean Energy Strategy&quot;</td>
<td></td>
</tr>
<tr>
<td>Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
<td>$9,690</td>
</tr>
<tr>
<td>Encompass Optimization without predefined Strategy</td>
<td>$9,572</td>
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</table>
### E. Clean Energy Strategy

**Retire & Replace Pete with Clean Energy**

**20-Year PVRR (2023$MM, 2023-2042)**

**Generation Strategy:**

"Clean Energy Strategy"
Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>No Environmental Action</th>
<th>Current Trends</th>
<th>Aggressive Environmental</th>
<th>Decarbonized Economy</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$9,690</td>
</tr>
</tbody>
</table>
Clean Energy Strategy: Decarbonized Economy

Retire & Replace Pete with Clean Energy

Firm Unforced Capacity Position – Summer

- Existing Coal
- Existing Natural Gas
- Existing Other (Wind/Solar/DR)
- Petersburg 3 & 4 Refuel to Natural Gas
- New Wind
- New Solar
- New Storage
- New Solar + Storage
- New Natural Gas
- Capacity Purchases
- PRMR
- PRMR less DSM
Clean Energy Strategy: Decarbonized Economy

Retire & Replace Pete with Clean Energy

Installed Capacity Cumulative Additions (MW)

<table>
<thead>
<tr>
<th>Year</th>
<th>Wind</th>
<th>Solar</th>
<th>Storage</th>
<th>Solar + Storage</th>
<th>Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>2023</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2024</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2025</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>2026</td>
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<tr>
<td>2028</td>
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<td>0</td>
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**Installed Capacity Incremental Additions (MW): 2023 – 2028**
Clean Energy Strategy: Decarbonized Economy

Retire & Replace Pete with Clean Energy

Energy Mix %

- Coal
- Natural Gas
- Wind
- Solar + Storage
- DSM

<table>
<thead>
<tr>
<th>Year</th>
<th>Thermal MWh %</th>
<th>Renewable/DSM MWh %</th>
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<tr>
<td>2023</td>
<td>92%</td>
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<td>2025</td>
<td>81%</td>
<td>19%</td>
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<tr>
<td>2028</td>
<td>57%</td>
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<td>2032</td>
<td>42%</td>
<td>58%</td>
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<tr>
<td>2042</td>
<td>14%</td>
<td>86%</td>
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Clean Energy Strategy: Decarbonized Economy
Retire & Replace Pete with Clean Energy

Portfolio Overview

Retirements
Petersburg:
→ Pete 3 Coal: 2026
→ Pete 4 Coal: 2028
→ Total Coal Retired MW: 1,040 MW

Harding Street:
→ HS ST5 Nat Gas: 2030
→ HS ST6 Nat Gas: 2030
→ HS ST7 Nat Gas: 2033
→ Total Retired Nat Gas MW: 618 MW

Replacements by 2042
→ DSM: 610 MW
→ Wind: 2,300 MW
→ Solar: 2,600 MW
→ Storage: 1,800 MW
→ Solar + Storage: 45 MW
→ Thermal: 0 MW

Current Trends PVRR Summary
20-Year PVRR (2023$MM, 2023-2042)

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>2023$MM</th>
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<tbody>
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<td>No Early Retirement</td>
<td>$9,917</td>
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<tr>
<td>Pete Refuel to 100% Gas (est. 2025)</td>
<td>$9,546</td>
</tr>
<tr>
<td>One Pete Unit Retires (2026)</td>
<td>$9,955</td>
</tr>
<tr>
<td>Both Pete Units Retire (2026 &amp; 2028)</td>
<td>$9,923</td>
</tr>
</tbody>
</table>
| "Clean Energy Strategy"
  Both Pete Units Retire and Replaced
  with Wind, Solar & Storage (2026 & 2028)     | $9,690  |
| Encompass Optimization without predefined Strategy | $9,572  |
## F. Encompass Optimization

**20-Year PVRR (2023$MM, 2023-2042)**

**Generation Strategy:**

*Encompass Optimization without predefined Strategy – Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027*

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>No Environmental Action</th>
<th>Current Trends</th>
<th>Aggressive Environmental</th>
<th>Decarbonized Economy</th>
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</thead>
<tbody>
<tr>
<td>$9,572</td>
<td>$9,572</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027
Encompass Optimization: Decarbonized Economy

Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

Firm Unforced Capacity Position - Summer

- Existing Coal
- Existing Natural Gas
- Existing Other (Wind/Solar/DR)
- Petersburg 3 & 4 Refuel to Natural Gas
- New Wind
- New Solar
- New Storage
- New Solar + Storage
- Capacity Purchases
- PRMR
- PRMR less DSM
**Encompass Optimization:** Decarbonized Economy

*Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027*

### Firm Unforced Capacity Position - Winter

- **UCAP MW**

<table>
<thead>
<tr>
<th>Year</th>
<th>Existing Coal</th>
<th>Existing Natural Gas</th>
<th>Existing Other (Wind/Solar/DR)</th>
<th>Petersburg 3 &amp; 4 Refuel to Natural Gas</th>
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</thead>
<tbody>
<tr>
<td>2022</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2023</td>
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<td></td>
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</tr>
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<td></td>
<td></td>
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</tr>
<tr>
<td>2033</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2034</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>2035</td>
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<td>2036</td>
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</tr>
<tr>
<td>2037</td>
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<td>2038</td>
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<td>2039</td>
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<td></td>
</tr>
<tr>
<td>2040</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2041</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2042</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Key Terms:**
  - **PRMR:** Power Reduction Management Resource
  - **PRMR less DSM:** PRMR minus Demand Side Management
Encompass Optimization: Decarbonized Economy

Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

### Installed Capacity Cumulative Additions (MW)

![Graph showing cumulative capacity additions from 2023 to 2028 for various energy sources: Wind, Solar, Storage, Solar + Storage, Gas, DSM (EE & DR)]

### Installed Capacity Incremental Additions (MW): 2023 - 2028

<table>
<thead>
<tr>
<th>Source</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2028</th>
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<td>400</td>
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<tr>
<td>Solar</td>
<td>0</td>
<td>0</td>
<td>325</td>
<td>33</td>
<td>0</td>
<td>65</td>
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<td>Storage</td>
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<td>0</td>
<td>260</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Solar + Storage</td>
<td>0</td>
<td>0</td>
<td>45</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Gas</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
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</table>
Encompass Optimization: Decarbonized Economy

Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

Energy Mix %

- Coal
- Natural Gas
- Wind
- Solar + Storage
- DSM

<table>
<thead>
<tr>
<th>Year</th>
<th>Coal</th>
<th>Natural Gas</th>
<th>Wind</th>
<th>Solar + Storage</th>
<th>DSM</th>
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<tr>
<td>2023</td>
<td>5%</td>
<td>48%</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>2025</td>
<td>3%</td>
<td>13%</td>
<td>2%</td>
<td>5%</td>
<td>-</td>
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<tr>
<td>2028</td>
<td>2%</td>
<td>18%</td>
<td>4%</td>
<td>8%</td>
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<tr>
<td>2031</td>
<td>7%</td>
<td>39%</td>
<td>6%</td>
<td>15%</td>
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<td>2040</td>
<td>47%</td>
<td>39%</td>
<td>10%</td>
<td>47%</td>
<td>-</td>
</tr>
</tbody>
</table>

Thermal MWh %: 92% 80% 62% 47% 15%
Renewable/DSM MWh %: 8% 20% 38% 53% 85%
Encompass Optimization: Decarbonized Economy

Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

Portfolio Overview

Retirements
Petersburg:
→ Pete 3 Coal: 2025
→ Pete 4 Coal: 2027
→ Total Refueled MW: 1,040 MW

Harding Street:
→ HS ST5 Nat Gas: 2030
→ HS ST6 Nat Gas: 2030
→ HS ST7 Nat Gas: 2033
→ Total Nat Gas Retired MW: 618 MW

Replacement Additions by 2042
→ DSM: 490 MW
→ Wind: 2,300 MW
→ Solar: 2,568 MW
→ Storage: 940 MW
→ Solar + Storage: 135 MW
→ Thermal: 0
→ Pete 3 & 4 Refueled to Nat Gas: 1,052 MW

Current Trends PVRR Summary
20-Year PVRR (2023$MM, 2023-2042)

<table>
<thead>
<tr>
<th>Scenarios</th>
<th></th>
</tr>
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<tbody>
<tr>
<td>No Early Retirement</td>
<td>$9,917</td>
</tr>
<tr>
<td>Pete Refuel to 100% Gas (est. 2025)</td>
<td>$9,546</td>
</tr>
<tr>
<td>One Pete Unit Retires (2026)</td>
<td>$9,955</td>
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<tr>
<td>Both Pete Units Retire (2026 &amp; 2028)</td>
<td>$9,923</td>
</tr>
<tr>
<td>&quot;Clean Energy Strategy&quot;</td>
<td></td>
</tr>
<tr>
<td>Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
<td>$9,690</td>
</tr>
<tr>
<td>Encompass Optimization without predefined Strategy</td>
<td>$9,572</td>
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</tbody>
</table>
## Portfolio Matrix

### 20-Year PVRR (2023$MM, 2023-2042)

<table>
<thead>
<tr>
<th>Generation Strategies</th>
<th>No Environmental Action</th>
<th>Current Trends (Reference Case)</th>
<th>Aggressive Environmental</th>
<th>Decarbonized Economy</th>
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<tr>
<td>No Early Retirement</td>
<td>$7,111</td>
<td>$9,572</td>
<td>$11,349</td>
<td>$9,917</td>
</tr>
<tr>
<td>Pete Refuel to 100% Gas (est. 2025)</td>
<td>$6,621</td>
<td>$9,330</td>
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<td>One Pete Unit Retires (2026)</td>
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<td>Both Pete Units Retire (2026 &amp; 2028)</td>
<td>$7,425</td>
<td>$9,618</td>
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<td>&quot;Clean Energy Strategy&quot; Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
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<td>$9,711</td>
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<td>$9,262</td>
<td>$10,994</td>
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</table>

### Encompass Optimization Results by Scenario:

- Refuels Petersburg Units 3 & 4 in 2025
- Refuels Petersburg Unit 3 in 2025 & Refuels Petersburg Unit 4 in 2027
- Refuels Petersburg Unit 4 in 2027
- Refuels Petersburg Unit 3 in 2025 & Refuels Petersburg Unit 4 in 2027
## Aggressive Environmental

### 20-Year PVRR (2023$MM, 2023-2042)

<table>
<thead>
<tr>
<th>Generation Strategies</th>
<th>Scenarios</th>
</tr>
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<tbody>
<tr>
<td>No Early Retirement</td>
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</tr>
<tr>
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<td>$11,181</td>
</tr>
<tr>
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<td>$11,470</td>
</tr>
<tr>
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<td>$11,145</td>
</tr>
<tr>
<td>“Clean Energy Strategy”</td>
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</tr>
<tr>
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<td>$11,184</td>
</tr>
<tr>
<td>Encompass Optimization without predefined Strategy – Selects Pete 4 Refuel in 2027</td>
<td>$10,994</td>
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</table>
# A. No Early Retirement

## Generation Strategy: No Early Retirement

<table>
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<tr>
<th>Scenarios</th>
<th>No Environmental Action</th>
<th>Current Trends</th>
<th>Aggressive Environmental</th>
<th>Decarbonized Economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>$11,349</td>
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</tr>
</tbody>
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No Early Retirement: Aggressive Environmental

Firm Unforced Capacity Position – Summer

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- AES Indiana
- Attachment 1-2
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No Early Retirement: Aggressive Environmental

Firm Unforced Capacity Position – Winter

UCAP MW

Existing Coal
New Wind
New Natural Gas
Existing Natural Gas
New Solar
New Storage
Existing Other (Wind/Solar/DR)
Petersburg 3 & 4 Refuel to Natural Gas
New Solar + Storage
Capacity Purchases
PRMR
PRMR less DSM
No Early Retirement: Aggressive Environmental

Installed Capacity Cumulative Additions (MW)

<table>
<thead>
<tr>
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<th>DSM (EE &amp; DR)</th>
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<th>Solar</th>
<th>Storage</th>
<th>Solar + Storage</th>
<th>Gas</th>
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<tbody>
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<td>0</td>
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<td>0</td>
<td>0</td>
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<td>0</td>
</tr>
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<td>2026</td>
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<td>0</td>
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<td>0</td>
</tr>
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Installed Capacity Incremental Additions (MW): 2023 - 2028

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<tr>
<th>Year</th>
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<th>Solar + Storage</th>
<th>Gas</th>
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No Early Retirement: Aggressive Environmental

Energy Mix %

Coal
Natural Gas
Wind
Solar + Storage
DSM

<table>
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<th>Year</th>
<th>Coal</th>
<th>Natural Gas</th>
<th>Wind</th>
<th>Solar + Storage</th>
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<td>8%</td>
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<td>8%</td>
<td>1%</td>
<td>35%</td>
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</tbody>
</table>

Thermal MWh %

- 2023: 92%
- 2025: 85%
- 2028: 55%
- 2032: 25%
- 2042: 11%

Renewable/DSM MWh %

- 2023: 8%
- 2025: 15%
- 2028: 45%
- 2032: 75%
- 2042: 89%
No Early Retirement: Aggressive Environmental

Portfolio Overview

Retirements

Harding Street:
- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
- Total Nat Gas Retired MW: 618 MW

Replacement Additions by 2042

- DSM: 462 MW
- Wind: 2,500 MW
- Solar: 2,535 MW
- Storage: 820 MW
- Solar + Storage: 45 MW
- Thermal: 0 MW

Current Trends PVRR Summary

20-Year PVRR (2023$MM, 2023-2042)

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<th>Scenarios</th>
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<td>Pete Refuel to 100% Gas (est. 2025)</td>
<td>$11,181</td>
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<td>One Pete Unit Retires (2026)</td>
<td>$11,470</td>
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<td>Both Pete Units Retire (2026 &amp; 2028)</td>
<td>$11,145</td>
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<tr>
<td>&quot;Clean Energy Strategy&quot; Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
<td>$11,184</td>
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<tr>
<td>Encompass Optimization without predefined Strategy</td>
<td>$10,994</td>
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# B. Pete Refuel by 2025

## Generation Strategy:
*Pete Refuel to 100% Gas (est. 2025)*

## 20-Year PVRR
*(2023$MM, 2023-2042)*

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<th>No Environmental Action</th>
<th>Current Trends</th>
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<th>Decarbonized Economy</th>
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<td><strong>$11,181</strong></td>
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**AES Indiana 2022 IRP Report**

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Pete 3 & 4 Refuel in 2025: Aggressive Environmental

Firm Unforced Capacity Position – Summer

- Existing Coal
- Petersburg 3 & 4 Refuel to Natural Gas
- Existing Natural Gas
- Existing Other (Wind/Solar/DR)
- New Wind
- New Solar
- New Storage
- New Natural Gas
- Capacity Purchases
- New Solar + Storage
- PRMR
- PRMR less DSM
Pete 3 & 4 Refuel in 2025: Aggressive Environmental
Pete 3 & 4 Refuel in 2025: Aggressive Environmental

Installed Capacity Cumulative Additions (MW)

Installed Capacity Incremental Additions (MW): 2023 - 2028

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Pete 3 & 4 Refuel in 2025: Aggressive Environmental

Energy Mix %

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<th>Wind</th>
<th>Solar + Storage</th>
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<tr>
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<td>54%</td>
<td>41%</td>
<td>2%</td>
<td>2%</td>
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</tbody>
</table>

Thermal MWh % | Renewable/DSM MWh % | Thermal MWh % | Renewable/DSM MWh % | Thermal MWh % | Renewable/DSM MWh % | Thermal MWh % | Renewable/DSM MWh % |
---|---|---|---|---|---|---|---|
92% | 8% | 70% | 30% | 53% | 79% | 11% | 89% |

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2022 IRP Report
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Pete 3 & 4 Refuel in 2025: Aggressive Environmental

Portfolio Overview

**Retirements**

Petersburg:
- Pete 3 & 4 Coal: 2025 Refuel with Nat Gas
- **Total Refueled MW: 1,040 MW**

Harding Street:
- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
- **Total Nat Gas Retired MW: 618 MW**

**Replacement Additions by 2042**

- DSM: 415 MW
- Wind: 2,500 MW
- Solar: 2,535 MW
- Storage: 820 MW
- Solar + Storage: 270 MW
- Thermal: 0
- Pete 3 & 4 Refueled to Nat Gas: 1,052 MW

Current Trends PVRR Summary

20-Year PVRR (2023$MM, 2023-2042)

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>Value</th>
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<td>Pete Refuel to 100% Gas (est. 2025)</td>
<td>$11,181</td>
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<tr>
<td>One Pete Unit Retires (2026)</td>
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<td>Both Pete Units Retire (2026 &amp; 2028)</td>
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<tr>
<td>&quot;Clean Energy Strategy&quot; Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
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<td>Encompass Optimization without predefined Strategy</td>
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### C. One Pete Unit Retires (2026)

**Generation Strategy:** One Pete Unit Retires (2026)

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<th>Aggressive Environmental</th>
<th>Decarbonized Economy</th>
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<td>$11,470</td>
</tr>
</tbody>
</table>

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2022 IRP Report
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One Pete Unit Retires (2026): Aggressive Environmental

Firm Unforced Capacity Position – Summer

- Existing Coal
- New Wind
- New Natural Gas
- Existing Natural Gas
- New Solar
- Existing Other (Wind/Solar/DR)
- Petersburg 3 & 4 Refuel to Natural Gas
- New Solar + Storage
- New Storage
- Capacity Purchases
- PRMR
- PRMR less DSM

UCAP MW

2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042
One Pete Unit Retires (2026): Aggressive Environmental

**Firm Unforced Capacity Position – Winter**

- **Existing Coal**
- **Existing Natural Gas**
- **Existing Other (Wind/Solar/DR)**
- **Petersburg 3 & 4 Refuel to Natural Gas**
- **New Wind**
- **New Solar**
- **New Storage**
- **New Solar + Storage**
- **Capacity Purchases**
- **PRMR**
- **PRMR less DSM**

UCAP MW:
- 0
- 500
- 1,000
- 1,500
- 2,000
- 2,500
- 3,000
- 3,500
- 4,000
One Pete Unit Retires (2026): Aggressive Environmental

**Installed Capacity Cumulative Additions (MW)**

![Bar chart showing cumulative additions of different energy sources](chart)

**Installed Capacity Incremental Additions (MW): 2023 - 2028**

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<thead>
<tr>
<th>Source</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2028</th>
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<td>400</td>
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<td>Solar + Storage</td>
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<td>0</td>
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<td>Gas</td>
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One Pete Unit Retires (2026): Aggressive Environmental

Energy Mix %

Coal  Natural Gas  Wind  Solar + Storage  DSM

Year 2023-2042

Thermal MWh %  Renewable/DSM MWh %
2023  92%  8%
2025  85%  13%
2028  77%  16%
2032  57%  30%
2042  35%  63%

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Portfolio Overview

Retirements
Petersburg:
→ Pete 3 Coal: 2026
→ Total Coal Retired MW: 520 MW

Harding Street:
→ HS ST5 Nat Gas: 2030
→ HS ST6 Nat Gas: 2030
→ HS ST7 Nat Gas: 2033
→ Total Nat Gas Retired MW: 618 MW

Replacement Additions by 2042
→ DSM: 490 MW
→ Wind: 2,500 MW
→ Solar: 2,600 MW
→ Storage: 1,240 MW
→ Solar + Storage: 180 MW
→ Thermal: 0 MW

Current Trends PVRR Summary
20-Year PVRR (2023$MM, 2023-2042)

<table>
<thead>
<tr>
<th>Scenarios</th>
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<tr>
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<tr>
<td>&quot;Clean Energy Strategy&quot;</td>
<td>$11,184</td>
</tr>
<tr>
<td>Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
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<tr>
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# D. Both Pete Units Retire (2026 & 2028)

## 20-Year PVRR (2023$MM, 2023-2042)

<table>
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<th>Generation Strategy: Both Pete Units Retire (2026 &amp; 2028)</th>
<th>Scenarios</th>
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Both Pete Units Retire: Aggressive Environmental

2026 & 2028

Firm Unforced Capacity Position – Summer
Both Pete Units Retire: Aggressive Environmental

Firm Unforced Capacity Position – Winter

- Existing Coal
- New Wind
- Existing Natural Gas
- New Solar
- Existing Other (Wind/Solar/DR)
- New Natural Gas
- Capacity Purchases
- Petersburg 3 & 4 Refuel to Natural Gas
- New Solar + Storage
- New Storage
- PRMR
- PRMR less DSM

UCAP MW

2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042
Both Pete Units Retire: Aggressive Environmental  
2026 & 2028

Installed Capacity Cumulative Additions (MW)

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<thead>
<tr>
<th>Year</th>
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<th>Storage</th>
<th>Solar + Storage</th>
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**Installed Capacity Incremental Additions (MW): 2023 – 2028**

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<th>Storage</th>
<th>Solar + Storage</th>
<th>Gas</th>
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</tr>
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Both Pete Units Retire: Aggressive Environmental
2026 & 2028

Energy Mix %

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<th>Coal MWh %</th>
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<th>Wind MWh %</th>
<th>Solar + Storage MWh %</th>
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<tr>
<td>2034</td>
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<tr>
<td>2040</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
<td>50%</td>
<td>40%</td>
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</table>
Both Pete Units Retire: Aggressive Environmental 2026 & 2028

Portfolio Overview

Retirements
Petersburg:
→ Pete 3 Coal: 2026
→ Pete 4 Coal: 2028
→ Total Coal Retired MW: 1,040 MW

Harding Street:
→ HS ST5 Nat Gas: 2030
→ HS ST6 Nat Gas: 2030
→ HS ST7 Nat Gas: 2033
→ Total Nat Gas Retired MW: 618 MW

Replacement Additions by 2042
→ DSM: 610 MW
→ Wind: 2,500 MW
→ Solar: 2,600 MW
→ Storage: 1,620 MW
→ Solar + Storage: 45 MW
→ Thermal: 0 MW

Current Trends PVRR Summary
20-Year PVRR (2023$MM, 2023-2042)

<table>
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<tr>
<th>Scenarios</th>
<th>2026 IRP Report</th>
<th>Page 553 of 647</th>
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<td>No Early Retirement</td>
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<td>Pete Refuel to 100% Gas (est. 2025)</td>
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<td>One Pete Unit Retires (2026)</td>
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<td></td>
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<tr>
<td>&quot;Clean Energy Strategy&quot; Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
<td>$11,184</td>
<td></td>
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<tr>
<td>Encompass Optimization without predefined Strategy</td>
<td>$10,994</td>
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### E. Clean Energy Strategy

**Retire & Replace Pete with Clean Energy**

**20-Year PVRR (2023$MM, 2023-2042)**

**Generation Strategy:**
```
“Clean Energy Strategy”
Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)
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<th>Scenarios</th>
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<th>Current Trends</th>
<th>Aggressive Environmental</th>
<th>Decarbonized Economy</th>
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<td><strong>$11,184</strong></td>
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</table>

AES Indiana
2022 IRP Report
Attachment 1-2
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Clean Energy Strategy: Aggressive Environmental

Retire & Replace Pete with Clean Energy

Firm Unforced Capacity Position – Summer

2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042

UCAP MW

0 500 1,000 1,500 2,000 2,500 3,000 3,500 4,000 4,500

- Existing Coal
- Existing Natural Gas
- Existing Other (Wind/Solar/DR)
- Petersburg 3 & 4 Refuel to Natural Gas
- New Wind
- New Solar
- New Storage
- New Solar + Storage
- New Natural Gas
- Capacity Purchases
- PRMR
- PRMR less DSM
Clean Energy Strategy: Aggressive Environmental
Retire & Replace Pete with Clean Energy

Firm Unforced Capacity Position – Winter

- Existing Coal
- New Wind
- New Natural Gas
- Existing Natural Gas
- New Solar
- Existing Other (Wind/Solar/DR)
- Capacity Purchases
- PRMR
- Petersburg 3 & 4 Refuel to Natural Gas
- New Solar + Storage
- New Solar + Storage
- PRMR less DSM

UCAP MW

2022 IRP Report attachment 1-2
Clean Energy Strategy: Aggressive Environmental

Retire & Replace Pete with Clean Energy

Installed Capacity Cumulative Additions (MW)

Installed Capacity Incremental Additions (MW): 2023 – 2028

<table>
<thead>
<tr>
<th></th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2028</th>
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<tbody>
<tr>
<td>Wind</td>
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<td>0</td>
<td>0</td>
<td>200</td>
<td>900</td>
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<tr>
<td>Solar</td>
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<td>0</td>
<td>0</td>
<td>293</td>
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<tr>
<td>Storage</td>
<td>0</td>
<td>0</td>
<td>300</td>
<td>420</td>
<td>0</td>
<td>60</td>
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<tr>
<td>Solar + Storage</td>
<td>0</td>
<td>0</td>
<td>45</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Gas</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tbody>
</table>
Clean Energy Strategy: Aggressive Environmental
Retire & Replace Pete with Clean Energy

Energy Mix %

- Coal
- Natural Gas
- Wind
- Solar + Storage
- DSM

<table>
<thead>
<tr>
<th>Year</th>
<th>Thermal MWh %</th>
<th>Renewable/DSM MWh %</th>
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<tbody>
<tr>
<td>2023</td>
<td>6%</td>
<td>38%</td>
</tr>
<tr>
<td>2025</td>
<td>5%</td>
<td>45%</td>
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<tr>
<td>2028</td>
<td>11%</td>
<td>45%</td>
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<tr>
<td>2032</td>
<td>6%</td>
<td>43%</td>
</tr>
<tr>
<td>2042</td>
<td>7%</td>
<td>41%</td>
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</tbody>
</table>
## Portfolio Overview

### Retirements

Petersburg:
- Pete 3 Coal: 2026
- Pete 4 Coal: 2028
  - **Total Coal Retired MW:** 1,040 MW

Harding Street:
- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
  - **Total Retired Nat Gas MW:** 618 MW

### Replacements by 2042

- DSM: 610 MW
- Wind: 2,500 MW
- Solar: 2,600 MW
- Storage: 1,620 MW
- Solar + Storage: 45 MW
- Thermal: 0 MW

## Current Trends PVRR Summary

20-Year PVRR (2023$MM, 2023-2042)

<table>
<thead>
<tr>
<th>Scenarios</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aggressive Environmental</strong></td>
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<tr>
<td>No Early Retirement</td>
</tr>
<tr>
<td>Pete Refuel to 100% Gas (est. 2025)</td>
</tr>
<tr>
<td>One Pete Unit Retires (2026)</td>
</tr>
<tr>
<td>Both Pete Units Retire (2026 &amp; 2028)</td>
</tr>
<tr>
<td>&quot;Clean Energy Strategy&quot; Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
</tr>
<tr>
<td>Encompass Optimization without predefined Strategy</td>
</tr>
</tbody>
</table>
### F. Encompass Optimization

Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

#### 20-Year PVRR (2023$MM, 2023-2042)

**Generation Strategy:**
Encompass Optimization without predefined Strategy – Selects Pete 4 Refuel in 2027

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>No Environmental Action</th>
<th>Current Trends</th>
<th>Aggressive Environmental</th>
<th>Decarbonized Economy</th>
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</thead>
<tbody>
<tr>
<td>$10,994</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Encompass Optimization: Aggressive Environmental

Selects Pete 4 Refuel in 2027

Firm Unforced Capacity Position – Summer

- Existing Coal
- New Wind
- Petersburg 3 & 4 Refuel to Natural Gas
- New Natural Gas
- Existing Natural Gas
- New Solar
- Existing Other (Wind/Solar/DR)
- New Storage
- PRMR
- Capacity Purchases
- PRMR less DSM
Encompass Optimization: Aggressive Environmental

Selects Pete 4 Refuel in 2027

Firm Unforced Capacity Position – Winter

UCAP MW

- Existing Coal
- New Wind
- New Natural Gas
- Petersburg 3 & 4 Refuel to Natural Gas
- New Solar
- Existing Natural Gas
- Existing Other (Wind/Solar/DR)
- New Storage
- Capacity Purchases
- PRMR
- PRMR less DSM

2022 IRP Report
Attachment 1-2
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Encompass Optimization: Aggressive Environmental
Selects Pete 4 Refuel in 2027

Installed Capacity Cumulative Additions (MW)

Installed Capacity Incremental Additions (MW): 2023 - 2028

<table>
<thead>
<tr>
<th></th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2028</th>
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</thead>
<tbody>
<tr>
<td>Wind</td>
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<td>50</td>
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<td>0</td>
<td>45</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pete Refuel</td>
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<td>0</td>
<td>0</td>
<td>526</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Gas</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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Encompass Optimization: Aggressive Environmental

Selects Pete 4 Refuel in 2027

Energy Mix %

Coal  Natural Gas  Wind  Solar + Storage  DSM

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<tr>
<th>Year</th>
<th>Coal</th>
<th>Natural Gas</th>
<th>Wind</th>
<th>Solar + Storage</th>
<th>DSM</th>
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<td>20%</td>
<td>30%</td>
<td>40%</td>
<td>20%</td>
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<tr>
<td>2025</td>
<td>5%</td>
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<td>50%</td>
<td>40%</td>
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<td>2028</td>
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<tr>
<td>2032</td>
<td>1%</td>
<td>30%</td>
<td>70%</td>
<td>20%</td>
<td>10%</td>
</tr>
<tr>
<td>2042</td>
<td>0%</td>
<td>40%</td>
<td>80%</td>
<td>10%</td>
<td>10%</td>
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</tbody>
</table>
Encompass Optimization: Aggressive Environmental

Selects Pete 4 Refuel in 2027

Portfolio Overview

Retirements
Petersburg:
- Pete 3 Coal: 2028 – Retired 520 MW
- Pete 4 Coal: 2026 – Refueled 520 MW

Harding Street:
- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
- Total Nat Gas Retired MW: 618 MW

Replacement Additions by 2042
- DSM: 490 MW
- Wind: 2,500 MW
- Solar: 2,600 MW
- Storage: 1,260 MW
- Solar + Storage: 90 MW
- Thermal: 0
- Pete 4 Refueled to Nat Gas: 526 MW

Current Trends PVRR Summary
20-Year PVRR (2023$MM, 2023-2042)

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>2023$MM</th>
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<td>$11,349</td>
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<tr>
<td>Pete Refuel to 100% Gas (est. 2025)</td>
<td>$11,181</td>
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<tr>
<td>One Pete Unit Retires (2026)</td>
<td>$11,470</td>
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<tr>
<td>Both Pete Units Retire (2026 &amp; 2028)</td>
<td>$11,145</td>
</tr>
<tr>
<td>&quot;Clean Energy Strategy&quot; Both Pete Units Retire and Replaced</td>
<td>$11,184</td>
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<tr>
<td>with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
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<tr>
<td>Encompass Optimization without predefined Strategy</td>
<td>$10,994</td>
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# Portfolio Matrix

## 20-Year PVRR (2023$MM, 2023-2042)

<table>
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<th>Generation Strategies</th>
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<th>Current Trends (Reference Case)</th>
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<td>$9,572</td>
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<td>Pete Refuel to 100% Gas (est. 2025)</td>
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<td>$7,425</td>
<td>$9,618</td>
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<td>$9,923</td>
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<td>“Clean Energy Strategy” Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
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<td>$9,711</td>
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<td>$9,262</td>
<td>$10,994</td>
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## Encompass Optimization Results by Scenario:

- Refuels Petersburg Units 3 & 4 in 2025
- Refuels Petersburg Unit 3 in 2025 & Refuels Petersburg Unit 4 in 2027
- Refuels Petersburg Unit 4 in 2027
- Refuels Petersburg Unit 3 in 2025 & Refuels Petersburg Unit 4 in 2027
2022 Integrated Resource Plan (IRP)

Public Advisory Meeting #5
10/31/2022
Agenda and Introductions

Stewart Ramsay, Managing Executive, Vanry & Associates
## Agenda

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>Speakers</th>
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<tr>
<td>Morning</td>
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<tr>
<td>Starting at 10:00 AM</td>
<td>Virtual Meeting Protocols and Safety</td>
<td>Chad Rogers, Director, Regulatory Affairs, AES Indiana</td>
</tr>
<tr>
<td></td>
<td>Welcome and Opening Remarks</td>
<td>Kristina Lund, President &amp; CEO, AES Indiana</td>
</tr>
<tr>
<td></td>
<td>IRP Schedule &amp; Timeline</td>
<td>Erik Miller, Manager, Resource Planning, AES Indiana</td>
</tr>
<tr>
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<td>IRP Framework Review</td>
<td>Erik Miller, Manager, Resource Planning, AES Indiana</td>
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<td></td>
<td>Risk &amp; Opportunity Metrics</td>
<td>Erik Miller, Manager, Resource Planning, AES Indiana</td>
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<td>Break</td>
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<td>12:00 PM – 12:30 PM</td>
<td>Lunch</td>
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<td>Afternoon</td>
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<tr>
<td>Starting at 12:30 PM</td>
<td>Reliability, Stability &amp; Resiliency Metric</td>
<td>Hisham Othman, Manager, Resource Planning, Quanta Technology</td>
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<td>IRP Scorecard Results</td>
<td>Erik Miller, Manager, Resource Planning, AES Indiana</td>
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<td>Preferred Resource Portfolio &amp; Short-Term Action Plan</td>
<td>Erik Miller, Manager, Resource Planning, AES Indiana</td>
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<td>Final Q&amp;A and Next Steps</td>
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Virtual Meeting
Protocols and Safety

Chad Rogers, Director, Regulatory Affairs, AES Indiana
IRP Team Introductions

AES Indiana Leadership Team
Kristina Lund, President & CEO, AES Indiana
Aaron Cooper, Chief Commercial Officer, AES Indiana
Brandi Davis-Handy, Chief Customer Officer, AES Indiana
Tanya Sovinski, Senior Director, Public Relations, AES Indiana
Ahmed Pasha, Chief Financial Officer, AES Indiana
Tom Raga, Vice President Government Affairs, AES Indiana
Sharon Schroder, Senior Director, Regulatory Affairs, AES Indiana
Kathy Storm, Vice President, US Smart Grid, AES Indiana

AES Indiana IRP Planning Team
Joe Bocanegra, Load Forecasting Analyst, AES Indiana
Erik Miller, Manager, Resource Planning, AES Indiana
Scott Perry, Manager, Regulatory Affairs, AES Indiana
Chad Rogers, Director, Regulatory Affairs, AES Indiana
Mike Russ, Senior Manager, T&D Planning & Forecasting, AES Asset Management
Brent Selvidge, Engineer, AES Indiana
Will Vance, Senior Analyst, AES Indiana
Kelly Young, Director, Public Relations, AES Indiana

AES Indiana IRP Partners
Annette Brocks, Senior Resource Planning Analyst, ACES
Patrick Burns, PV Modeling Lead and Regulatory/IRP Support, Brightline Group
Eric Fox, Director, Forecasting Solutions, Itron
Jeffrey Huber, Overall Project Manager and MPS Lead, GDS Associates
Jordan Janflone, EV Modeling Forecasting, GDS Associates
Patrick Maguire, Executive Director of Resource Planning, ACES
Hisham Othman, Vice President, Transmission and Regulatory Consulting, Quanta Technology
Stewart Ramsey, Managing Executive, Vanry & Associates
Mike Russo, Forecast Consultant, Itron
Jacob Thomas, Market Research and End-Use Analysis Lead, GDS Associates
Melissa Young, Demand Response Lead, GDS Associates
Danielle Powers, Executive Vice President, Concentric Energy Advisors
Meredith Stone, Senior Project Manager, Concentric Energy Advisors

AES Indiana Legal Team
Nick Grimmer, Indiana Regulatory Counsel, AES Indiana
Teresa Morton Nyhart, Counsel, Barnes & Thornburg LLP
Welcome to Today’s Participants

Advanced Energy Economy
Barnes & Thornburg LLP
Bose, McKinney & Evans LLP
CenterPoint Energy
Citizens Action Coalition
City of Indianapolis
Demand Side Analytics
Develop Indy | Indy Chamber
Earth Charter Indiana
EDPR North America
Energy Futures Group
Faith in Place
Hallador Energy
Hoosier Energy
IBEW Local Union 1395
Indiana Farm Bureau, Inc.
Indiana Friends Committee On Legislation
Indiana Michigan Power

Indiana Office of Energy Development
Indiana Utility Regulatory Commission
IUPUI
Indiana Office of Utility Consumer Counselor
Key Capture Energy
NIPSCO
NuScale Power
Power Takeoff
Purdue - State Utility Forecasting Group
R3 Renewables
Ranger Power
Rolls-Royce/ISS
Sierra Club
Solar United Neighbors
Synapse Energy Economics
Wartsila

... and members of the AES Indiana team and the public!
Virtual Meeting Best Practices

Questions

- Your candid feedback and input is an integral part to the IRP process.
- Questions or feedback will be taken at the end of each section.
- Feel free to submit a question in the chat function at any time and we will ensure those questions are addressed.

Audio

- All lines are muted upon entry.
- For those using audio via Teams, you can unmute by selecting the microphone icon.
- If you are dialed in from a phone, press *6 to unmute.

Video

- Video is not required. To minimize bandwidth, please refrain from using video unless commenting during the meeting.
AES Purpose & Values

Accelerating the future of energy, together.
Safety First

1. AES Indiana strives to provide a place of employment that is free from recognized hazards and one that **meets or exceeds governmental regulations** regarding occupational health and safety.

2. AES Indiana considers occupational health and safety a **fundamental value** of the organization and is a **key performance indicator** of the overall success of the company.

3. AES Indiana’s ultimate objective is that each day all AES Indiana people, contractors, and the public we serve return home to their family, friends, and community **free from harm**.
Meeting our customers’ needs today and tomorrow

AES Indiana is leading the inclusive, clean energy transition.

- Reliability
- Affordability
- Sustainability
Gradual change to the AES Indiana portfolio over time

2009-2015
Signed 100 MW PPA at Hoosier Wind Park in NW Indiana, 200 MW PPA at Lakefield Wind Farm in Minnesota and 96 MW PPA for solar in Indianapolis through Rate REP

2016
Retired 260 MW of coal at Eagle Valley

2016
Finalized refuel of 630 MW of coal-fired generation at Harding Street to natural gas

2018
Eagle Valley 671 MW Gas-Fired Combined Cycle Plant Completed

2021-2023
Retired (Unit 1) 220 MW of coal at Petersburg; Plans to retire (Unit 2) 401 MW of coal at Petersburg in 2023

2023 – 2024
Plans to complete 195 MW Hardy Hills Solar project and 250 MW + 180 MWh Petersburg Energy Center solar + storage project
Capabilities and infrastructure of current fleet

Largest sites have valuable capabilities and infrastructure for the energy transition

**Petersburg**
- Experienced, skilled labor force
- Land, interconnection, water rights
- Water treatment, natural gas pipelines already present on site

**Harding Street**
- Experienced, skilled labor force
- Land, interconnection, location near load center, rail, water rights

**Eagle Valley**
- New plant, highly efficient, flexible for future grid changes

AES Indiana seeks to partner with Pike County and City of Indianapolis to drive customer value and community impact of Petersburg and Harding Street Sites.
Short-term Action Plan Uses Existing Capacity and Adds Significant Renewables

1. **CONVERT**
   Convert Petersburg units 3 & 4 (1,052 MW) to natural gas in 2025 via existing pipeline on site

2. **ADD RENEWABLES**
   Add up to 1300 MW of wind, solar, and storage as early as 2025

3. **MONITOR**
   Monitor emerging technologies for inclusion in future planning

PREFERRED PORTFOLIO MAINTAINS OPTIONALITY FOR THE FUTURE
Short-term Action Plan Best Serves Our Customers’ Objectives

1. RELIABILITY
   → Highest composite reliability score

2. AFFORDABILITY
   → Saves AES Indiana customers more than $200M

3. SUSTAINABILITY
   → Provides 68% reduction in carbon intensity in 2030 compared to 2018
IRP Schedule & Timeline

Erik Miller, Manager, Resource Planning, AES Indiana
Updated 2022 IRP Timeline

Market Potential Study – Includes biweekly stakeholder meetings
Load Forecast
Distribution System Planning
Other Inputs & Assumptions

2022

Core IRP Modeling
Portfolio Evaluation & Risk
Report Narrative
Issue and Evaluate Generation RFP

AES Indiana is available for additional touchpoints with stakeholders to discuss IRP-related topics.
Public Advisory Schedule

Public Advisory Meeting #1 – January 24, 2022
- 2022 IRP Schedule & Progress
- 2019 IRP Recap
- Load, EV, DG Forecasts
- MPS Overview

Public Advisory Meeting #2 – April 12, 2022
- Load Scenarios
- MPS Results & DSM Inputs
- Replacement Resource Assumptions
- IRP Portfolio Matrix & Scenario Framework

Public Advisory Meeting #3 – June 27, 2022
- Stakeholder Presentations
- Portfolio Metrics & Scorecard Framework
- MISO Reliability Planning
- IRP Reliability Analysis
- Distribution System Plan

Public Advisory Meeting #4 – September 19, 2022
- Preliminary Modeling Results
- Preliminary Scorecard Results

Public Advisory Meeting #5 – October 31, 2022
- Risk & Opportunity Metrics
- Reliability Analysis
- Final Scorecard Review
- Preferred Resource Portfolio & Short-Term Action Plan

Topics for meeting 5 are subject to change.
IRP Process Overview

Core IRP Modeling & Evaluation

- Capacity Expansion Modeling
  - Retirement and replacement analysis
  - Portfolio optimization

- Production Cost Modeling & PVRR
  - Prod Cost - Portfolio dispatch analysis serve as PVRR inputs
  - Portfolio PVRR analysis
  - Stochastic risk analysis

- Portfolio Evaluation & Short-Term Action Plan
  - Screen against Evaluation Criteria
  - Selection of Preferred Resource Portfolio & Short-Term Action Plan

- IRP Submission Dec. 1, 2022

Contributors:
- DSM MPS – GDS Associates
- RFP – Sargent and Lundy
- DSP – Internal & Conrad Technical Services
- Load Forecast – Itron
- PVRR Calculations – Concentric
- Reliability Analysis – Quanta
- IRP Modeling & Evaluation – Internal with ACES & Anchor Power support

- DSM Market Potential Study (MPS)
  - End Use Analysis
  - Comprehensive measure list
  - Measure uptake & potentials: MAP & RAP
  - Develop IRP model inputs (bundled)

- Replacement Resource Costs
  - Cost assumptions from 2020 RFP and Consultants, e.g. Wood Mackenzie, NREL
  - New RFP issued

- Distribution System Planning (DSP)
  - Bottom-up forecast on sample of constrained circuits
  - Assess EV and DG impacts
  - Load shapes inform IRP analysis

- Load Forecast
  - Itron SAE Methodology
  - Base, High & Low Scenarios
  - IRP model peak and energy inputs
IRP Framework Review

Erik Miller, Manager, Resource Planning, AES Indiana
## Final Portfolio Matrix

**Results from Capacity Expansion Scenario Analysis**

<table>
<thead>
<tr>
<th>20-Year PVRR (2023$MM, 2023-2042)</th>
<th>No Environmental Action</th>
<th>Current Trends (Reference Case)</th>
<th>Aggressive Environmental</th>
<th>Decarbonized Economy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Generation Strategies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Early Retirement</td>
<td>$7,111</td>
<td>$9,572</td>
<td>$11,349</td>
<td>$9,917</td>
</tr>
<tr>
<td>Pete Refuel to 100% Gas (est. 2025)</td>
<td>$6,621</td>
<td>$9,330</td>
<td>$11,181</td>
<td>$9,546</td>
</tr>
<tr>
<td>One Pete Unit Retires (2026)</td>
<td>$7,462</td>
<td>$9,773</td>
<td>$11,470</td>
<td>$9,955</td>
</tr>
<tr>
<td>Both Pete Units Retire (2026 &amp; 2028)</td>
<td>$7,425</td>
<td>$9,618</td>
<td>$11,145</td>
<td>$9,923</td>
</tr>
<tr>
<td>&quot;Clean Energy Strategy&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
<td>$9,211</td>
<td>$9,711</td>
<td>$11,184</td>
<td>$9,690</td>
</tr>
<tr>
<td>Encompass Optimization without predefined Strategy</td>
<td>$6,610</td>
<td>$9,262</td>
<td>$10,994*</td>
<td>$9,572</td>
</tr>
</tbody>
</table>

**Encompass Optimization Results by Scenario:**

- Refuels Petersburg Units 3 & 4 in 2025
- Refuels Petersburg Unit 3 in 2025 & Refuels Petersburg Unit 4 in 2027
- Refuels Petersburg Unit 4 in 2027 Retires Unit 3 in 2028*
- Refuels Petersburg Unit 3 in 2025 & Refuels Petersburg Unit 4 in 2027

*Refueling Pete 3 & 4 at the same time provides cost efficiencies. These efficiencies are not captured when only one unit refuels.*
Replacement Resource Cost Sensitivity Analysis

Key Takeaways & PVRR Results

- As capital costs increase, fewer renewables are built for their energy value to the portfolio.
- As capital costs increase, newly constructed natural gas becomes more cost effective – less high price volatility with the cost to construct natural gas.
- Across the range of Replacement Resource Costs, refueling Petersburg provides a low PVRR.

20-Year PVRR (2023$MM, 2023-2042)

<table>
<thead>
<tr>
<th>Generation Strategies</th>
<th>Low</th>
<th>Base</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Early Retirement</td>
<td>$9,054</td>
<td>$9,572</td>
<td>$9,876</td>
</tr>
<tr>
<td>Pete Refuel to 100% Gas (est. 2025)</td>
<td>$8,698</td>
<td>$9,330</td>
<td>$9,661</td>
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<tr>
<td>One Pete Unit Retires (2026)</td>
<td>$9,081</td>
<td>$9,773</td>
<td>$10,181</td>
</tr>
<tr>
<td>Both Pete Units Retire (2026 &amp; 2028)</td>
<td>$8,790</td>
<td>$9,618</td>
<td>$10,178</td>
</tr>
<tr>
<td>&quot;Clean Energy Strategy&quot;</td>
<td>$8,787</td>
<td>$9,711</td>
<td>$10,586</td>
</tr>
<tr>
<td>Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
<td>$8,670*</td>
<td>$9,262</td>
<td>$9,624</td>
</tr>
</tbody>
</table>

Encompass Optimization without predefined Strategy

Current Trends (Reference Case)

Encompass Optimization Portfolios

- Refuels Petersburg Unit 3 in 2025 & Refuels Petersburg Unit 4 in 2028*
- Refuels Petersburg Unit 3 in 2025 & Refuels Petersburg Unit 4 in 2027
- Refuels Petersburg Unit 1 in 2025 & Refuels Petersburg Unit 4 in 2027

*Refueling Pete 3 & 4 at the same time provides cost efficiencies. These efficiencies are not captured when only one unit refuels.
## Preliminary Scorecard Results

The IRP Scorecard evaluates the **Candidate Portfolios (Strategies in Current Trends/Reference Case)** using metrics that fit into five categories.

<table>
<thead>
<tr>
<th>Affordability</th>
<th>Environmental Sustainability</th>
<th>Reliability, Stability &amp; Resiliency</th>
<th>Risk &amp; Opportunity</th>
<th>Economic Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-yr PVRR</td>
<td>CO₂ Emissions</td>
<td>Coal Combustion Products (CCP)</td>
<td>General Cost Opportunity <strong>Stochastic Analysis</strong></td>
<td>Portfolio PVRR w/ low renewable cost ($000,000)</td>
</tr>
<tr>
<td></td>
<td>SO₂ Emissions</td>
<td>Clean Energy Progress</td>
<td>General Cost Risk <strong>Stochastic Analysis</strong></td>
<td>Portfolio PVRR w/ high renewable cost ($000,000)</td>
</tr>
<tr>
<td></td>
<td>NOₓ Emissions</td>
<td>Reliability Score</td>
<td>P5 Mean - P5</td>
<td>Total change in FTEs associated with generation 2023 - 2042</td>
</tr>
<tr>
<td></td>
<td>Water Use</td>
<td>% Renewable Energy in 2032</td>
<td>P95 (Mean - P95)</td>
<td>Total amount of property tax paid from AES IN assets ($000,000)</td>
</tr>
<tr>
<td></td>
<td>CCP (tons)</td>
<td>Composite score from Reliability Analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water Use (mgal)</td>
<td>Lowest PVRR across policy scenarios ($000,000)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Coal Combustion Products (CCP)</td>
<td>Highest PVRR across policy scenarios ($000,000)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>% Renewable Energy in 2032</td>
<td>20-year avg sales + purchases (GWh)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Renewable Capital Cost Opportunity (Low Cost)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Renewable Capital Cost Risk (High Cost)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Employees (+/-)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Property Taxes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Strategies
- 1. No Early Retirement
- 2. Pete Refuel to 100% Natural Gas (est. 2025)
- 3. One Pete Unit Retires in 2026
- 4. Both Pete Units Retire in 2026 & 2028
- 5. “Clean Energy Strategy” – Both Pete Units Retire and replaced with Renewables in 2026 & 2028
- 6. Encompass Optimization without Predefined Strategy – Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

→ In Meeting #4 – we reviewed a partially completed Scorecard.

Today, we will review the remaining metrics and completed Scorecard.

The Meeting will conclude with review of the Preferred Resource Portfolio and Short-term Action Plan.
Risk and Opportunity Metrics

Erik Miller, Manager, Resource Planning, AES Indiana
AES Indiana included four **Risk & Opportunity Metrics** on the IRP Scorecard. Analyses were performed on the Candidate Portfolios to quantify these metrics – analyses include:

- Environmental Policy Sensitivity Analysis
- Cost Risk & Opportunity Metric **Stochastic Analysis**
- Market Interaction/Exposure Analysis
- Renewable Resource Capital Cost Sensitivity Analysis

The following slides will review the results from each analysis performed to quantify these metrics.
AES Indiana modeled environmental policy sensitivities on the optimized capacity expansion results from the Candidate Portfolios (Current Trends/Reference Case) to understand how the PVRR may change using different environmental policy and commodities.

The results will help to answer the question: “How would the optimized Reference Case perform in a very different policy future, e.g. Reference Case in a Decarbonized Economy future?”

<table>
<thead>
<tr>
<th>Generation Strategies</th>
<th>Current Trends – Reference Case</th>
<th>No Environmental Action</th>
<th>Aggressive Environmental</th>
<th>Decarbonized Economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Early Retirement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pete Refuel to 100% Gas (est. 2025)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One Pete Unit Retires (2026)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Both Pete Units Retire (2026 &amp; 2028)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Encompass Optimization without predefined Strategy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Run the Optimized Reference Case Portfolios/Generation Mixes through the other Scenarios

Metrics

For each strategy, the analysis will capture:

- Risk potential using the highest scenario PVRR for each strategy
- Opportunity potential using the lowest scenario PVRR for each strategy
<table>
<thead>
<tr>
<th>Generation Strategies</th>
<th>Current Trends – Reference Case</th>
<th>No Environmental Action</th>
<th>Aggressive Environmental</th>
<th>Decarbonized Economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Early Retirement</td>
<td>$9,572</td>
<td>$8,860</td>
<td>$11,259</td>
<td>$9,953</td>
</tr>
<tr>
<td>Pete Refuel to 100% Gas (est. 2025)</td>
<td>$9,330</td>
<td>$8,564</td>
<td>$11,329</td>
<td>$9,699</td>
</tr>
<tr>
<td>One Pete Unit Retires (2026)</td>
<td>$9,773</td>
<td>$9,288</td>
<td>$11,462</td>
<td>$10,084</td>
</tr>
<tr>
<td>Both Pete Units Retire (2026 &amp; 2028)</td>
<td>$9,618</td>
<td>$9,135</td>
<td>$11,392</td>
<td>$10,334</td>
</tr>
<tr>
<td>Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
<td>$9,711</td>
<td>$9,590</td>
<td>$11,275</td>
<td>$9,776</td>
</tr>
<tr>
<td>Encompass Optimization (Refuel in 2025 &amp; 2027)</td>
<td>$9,262</td>
<td>$8,517</td>
<td>$11,226</td>
<td>$9,721</td>
</tr>
</tbody>
</table>

**Key takeaways/explanations**

- **Low gas prices and no carbon price drive the Pete Refuel to be the least cost portfolio in the No Env Action scenario.**
- **Low-capacity factor due to negative spark spreads (power and gas) drives the Pete Refuel to be the least cost portfolio in the Decarb Econ scenario – portfolio has low energy from gas units and high energy from renewables to meet RPS.**
- **Base coal prices dampen the impact of higher carbon prices and higher NOx, which results in comparatively low PVRR for No Early Retirement in the Agg Env scenario.**
Risk & Opportunity Metrics:

Cost Risk & Opportunity Metric **Stochastic Analysis**

- Stochastic analysis was performed on the Candidate Portfolios to understand the risks and opportunities to each Strategy from:
  - Energy price volatility
  - Gas price volatility
  - Coal price volatility
  - Load volatility
  - Renewable generation volatility

- Each variable was varied across a full stochastic distribution using 100 iterations of potential outcomes.

- Metrics to measure cost risks and cost opportunities include:
  - Risk Metric = P95 and [P95 – Mean]
  - Opportunity Metric = P5 and [Mean – P5]
Risk & Opportunity Metrics:
Cost Risk & Opportunity Metric **Stochastic Analysis**

In order to fully evaluate commodity risk, the stochastic analysis captures recent volatility in commodity prices in forecasted distributions.

Henry Hub Gas Prices for 100 Stochastic Iterations included in Analysis

P95: $8.18
Mean: $4.63
P5: $2.24
All Candidate Portfolios rely partly on gas generation and therefore exhibit sensitivity to gas price volatility.

**Stochastic Analysis**

![PVRR Sensitivity to Natural Gas Prices](chart)

- **Refuel**
- **Clean Energy Strategy**

![Graph](image)
Stochastic results from varying power prices, gas prices, coal prices, load and renewable generation.

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>Scorecard PVRR Metric</th>
<th>Mean ↓</th>
<th>Opportunity: P5 (Mean - P5)</th>
<th>Risk: P95 (P95 - Mean)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Early Retirement</td>
<td>$9,572</td>
<td>$9,535</td>
<td>$9,271 [-$264]</td>
<td>$9,840 [$305]</td>
</tr>
<tr>
<td>Pete Refuel to 100% Gas (est. 2025)</td>
<td>$9,330</td>
<td>$9,364</td>
<td>$9,030 [-$334]</td>
<td>$9,746 [$382]</td>
</tr>
<tr>
<td>One Pete Unit Retires (2026)</td>
<td>$9,773</td>
<td>$9,902</td>
<td>$9,608 [-$294]</td>
<td>$10,237 [$336]</td>
</tr>
<tr>
<td>Both Pete Units Retire (2026 &amp; 2028)</td>
<td>$9,618</td>
<td>$9,582</td>
<td>$9,295 [-$287]</td>
<td>$9,903 [$321]</td>
</tr>
<tr>
<td>&quot;Clean Energy Strategy&quot;</td>
<td>$9,711</td>
<td>$9,727</td>
<td>$9,447 [-$280]</td>
<td>$10,039 [$312]</td>
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<tr>
<td>EnCompass Optimization (Refuel 2025 &amp; 2027)</td>
<td>$9,262</td>
<td>$9,277</td>
<td>$8,952 [-$324]</td>
<td>$9,629 [$352]</td>
</tr>
</tbody>
</table>
Risk & Opportunity Metrics:

Cost Risk & Opportunity Metric **Stochastic Analysis**

→ Converting Petersburg to natural gas provides lowest PVRR at the P95 (risk) and the lowest PVRR at the P5 (opportunity) compared to the other strategies.

→ Converting Petersburg to natural gas exhibits the widest distribution due to gas price volatility.

→ Continuing to operate Petersburg on coal provides the tightest distribution because coal prices are subject to less volatility compared to other commodities.
Risk & Opportunity Metrics: Market Interaction/Exposure

→ When a utility generates energy in excess of load, the energy is sold into the market. Conversely, when a utility is short energy, the utility must purchase energy to supply load.
→ Generally, the less sales and purchases in a portfolio, the less risky the portfolio or strategy is for the customer because the sales and purchases aren't exposed to price volatility in the market.
→ For example – what if prices drop to zero when wind is available in excess of load or what if prices spike when energy purchases are needed to meet load?

To estimate this risk for each strategy, AES Indiana calculated the average of the absolute value of the annual sales and purchases and summed those over the 20-yr period.
Risk & Opportunity Metrics:

Market Interaction/Exposure Results

<table>
<thead>
<tr>
<th>Candidate Portfolios (Strategies in Current Trends/Ref Case)</th>
<th>20-yr Annual Avg Market Sales (GWh)</th>
<th>20-yr Annual Avg Market Purchases (GWh)</th>
<th>Market Interaction/Exposure (GWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Early Retirement</td>
<td>2,935</td>
<td>2,356</td>
<td>5,291</td>
</tr>
<tr>
<td>Pete Refuel to 100% Natural Gas (2025)</td>
<td>2,346</td>
<td>2,877</td>
<td>5,222</td>
</tr>
<tr>
<td>One Pete Unit Retires in 2026</td>
<td>2,916</td>
<td>2,821</td>
<td>5,737</td>
</tr>
<tr>
<td>Both Pete Units Retire in 2026 &amp; 2028</td>
<td>2,921</td>
<td>2,591</td>
<td>5,512</td>
</tr>
<tr>
<td>“Clean Energy Strategy”*</td>
<td>3,146</td>
<td>2,942</td>
<td>6,088</td>
</tr>
<tr>
<td>Encompass Optimization**</td>
<td>2,285</td>
<td>2,851</td>
<td>5,136</td>
</tr>
</tbody>
</table>

*Both Pete Units Retire and replaced with Renewables in 2026 & 2028
**Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

Comparing across strategies, we see portfolios with less dispatchable generation have higher market interaction in the form of energy sales.
Risk & Opportunity Metrics:

Market Interaction/Exposure Example and Comparison

- Strategies with less dispatchable generation typically have higher market interaction in the form of sales due to inability to control when energy is generated.

- In the near term, the Clean Energy Strategy adds more renewables to replace Petersburg, resulting in comparatively higher sales.

- Starting in 2031, both strategies add similar amounts of renewables, so we see sales grow somewhat proportionally.

Market Interaction Comparison – Pete Refuel Strategy vs Clean Energy Strategy
Risk & Opportunity Metrics:

Renewable Resource Capital Cost Sensitivity Analysis

The Renewable Resource Capital Cost Sensitivity Analysis evaluates how much the Candidate Portfolio's PVRRs would change if renewable resource costs end up being higher or lower than the base assumptions.

How the analysis was performed

→ Using secondary data sources and the responses from AES Indiana’s past two RFPs that were issued in 2020 and the spring of 2022, the IRP team created low, base and high levels of renewable resource capital costs.

→ Low – low costs were based on the avg of the 2021 replacement resource capital cost forecasts from Wood Mackenzie, NREL and BNEF and benchmarked against the responses from AES Indiana’s 2020 RFP.

→ Base – base costs were based on the lower half of the 2022 all-source RFP responses.

→ High – high costs were based on the upper half of the 2022 all-source RFP responses.

→ The Renewable Resource Capital Cost Sensitivity analysis was performed by using the high and low cost calculations to increase and decrease the capital costs for the renewable additions in the Candidate Portfolios.
Risk & Opportunity Metrics:

Renewable Resource Capital Costs – Low, Base & High

- **Wind**
  - Low (Northern Wind)
  - Low (Southern Wind)
  - Base (Northern Wind)
  - Base (Southern Wind)
  - High (Northern Wind)
  - High (Southern Wind)

- **Solar**
  - Low
  - Base
  - High

- **Storage**
  - Low
  - Base
  - High

- **Solar + Storage**
  - Low
  - Base
  - High
### Risk & Opportunity Metrics:

#### Renewable Resource Capital Cost Sensitivity Analysis Results

Portfolios with the highest renewable investment are most sensitive to price fluctuations.

<table>
<thead>
<tr>
<th><strong>Current Trends (Reference Case)</strong></th>
<th>Low</th>
<th>Base</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Early Retirement</td>
<td>$9,080</td>
<td>$9,572</td>
<td>$10,157</td>
</tr>
<tr>
<td>Pete Refuel to 100% Gas (est. 2025)</td>
<td>$8,763</td>
<td>$9,330</td>
<td>$9,999</td>
</tr>
<tr>
<td>One Pete Unit Retires (2026)</td>
<td>$9,244</td>
<td>$9,773</td>
<td>$10,406</td>
</tr>
<tr>
<td>Both Pete Units Retire (2026 &amp; 2028)</td>
<td>$9,104</td>
<td>$9,618</td>
<td>$10,249</td>
</tr>
<tr>
<td>Both Pete Units Retire and Replaced with Wind, Solar &amp; Storage (2026 &amp; 2028)</td>
<td>$9,017</td>
<td>$9,711</td>
<td>$10,442</td>
</tr>
<tr>
<td>Encompass Optimization without predefined Strategy (Refuel 2025 &amp; 2027)</td>
<td>$8,730</td>
<td>$9,262</td>
<td>$9,909</td>
</tr>
</tbody>
</table>

**Opportunity Metric:** Candidate Portfolios using low costs for renewables

**Risk Metric:** Candidate Portfolios using high costs for renewables

---

### **RESULTS**

- **Opportunity Metric:** Candidate Portfolios using low costs for renewables
- **Risk Metric:** Candidate Portfolios using high costs for renewables
## Break for Lunch

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>Speakers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Break</strong></td>
<td>Lunch</td>
<td></td>
</tr>
<tr>
<td>12:00 PM – 12:30 PM</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Afternoon</strong></td>
<td>Reliability, Stability &amp; Resiliency Metric</td>
<td>Hisham Othman, Manager, Resource Planning, Quanta Technology</td>
</tr>
<tr>
<td>Starting at 12:30 PM</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IRP Scorecard Results</td>
<td>Erik Miller, Manager, Resource Planning, AES Indiana</td>
</tr>
<tr>
<td></td>
<td>Preferred Resource Portfolio &amp; Short-Term Action Plan</td>
<td>Erik Miller, Manager, Resource Planning, AES Indiana</td>
</tr>
<tr>
<td></td>
<td>Final Q&amp;A and Next Steps</td>
<td></td>
</tr>
</tbody>
</table>
Reliability, Resiliency & Stability Metric

Hisham Othman, VP Transmission & Regulatory Consulting, Quanta
Managing System Reliability – High IBR Portfolios

- Traditional planning ensures the provision of sufficient generation and transmission capacity based on:
  - Centralized synchronous generation
  - Dispatchable resources
  - Predictable flow patterns
  - Excludes fuel constraints
  - Few operating snapshots (e.g., 2-4)
  - Separate T and D planning

With increasing retirements and dependence on solar/wind/storage resources, both distributed and utility-scale, planning paradigm is evolving to assure operational reliability.

- Traditional planning methods are evolving:
  - Resource Adequacy: Effective Load Carrying Capability (ELCC)
  - Time-series transmission security (8760 hrs)
  - Probabilistic production cost simulations (renewable/load profiles)
  - Coordinated/Integrated T&D planning
  - Scenario planning approaches to address increased uncertainty

- More analysis is required - Essential Reliability Service
Essential Reliability Services

- Market-Procured Reliability Services
  - Some reliability services are typically procured competitively by the RTO or the ISO such as capacity, energy, and reserves.

- Portfolio-Supplied Reliability Services
  - Some reliability services are assumed to be innately supplied by the resource portfolio such as inertial and primary frequency response and voltage support.

### Service Category

<table>
<thead>
<tr>
<th>Service Category</th>
<th>Timescale</th>
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<tbody>
<tr>
<td></td>
<td>mS</td>
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<tr>
<td>Energy and Capacity</td>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Freq Responsive Reserves</td>
<td></td>
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<tr>
<td>Operating Reserves</td>
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</tr>
<tr>
<td>Other</td>
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</tr>
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<td></td>
<td></td>
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</table>

*Not procured by markets*
# Essential Reliability Studies

<table>
<thead>
<tr>
<th>Reliability Study Area</th>
<th>Normal (50/50, Connected)</th>
<th>Max-Gen (90/10, Import Limited)</th>
<th>Islanded (Critical Load)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Resource Adequacy</td>
<td>X (also 90/10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Energy Adequacy</td>
<td>X (8760)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Transmission Reliability / Deliverability / Interconnections</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Energy Adequacy
2. Operational Flexibility and Frequency Support
3. Short Circuit Strength Requirement
4. Power Quality (Flicker)
5. Blackstart
6. Dynamic VAR Deliverability
7. Dispatchability and Automatic Generation Control
8. Predictability and Firmness of Supply
9. Geographic Location Relative to Load

Typically, Part of IRP Portfolio Design

Additional Reliability Analysis
## Reliability Metrics (1/2)

<table>
<thead>
<tr>
<th>Metric</th>
<th>Description</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Energy Adequacy</td>
<td>Resources are able to meet the energy and capacity duration requirements. Portfolio resources are able to supply the energy demand of customers during normal and emergency max gen events, and also to supply the energy needs of critical loads during islanded operation events.</td>
<td>Utility must have long duration resources to serve the needs of its customers during emergency and islanded operation events.</td>
</tr>
<tr>
<td>2 Operational Flexibility</td>
<td>Ability to provide inertial energy reservoir or a sink to stabilize the system. Additionally, resources can adjust their output to provide frequency support or stabilization in response to frequency deviations with a droop of 5% or better.</td>
<td>Regional markets and/or control centers balance supply and demand under different time frames according to prevailing market construct under normal conditions, but preferable that local control centers possess the ability to maintain operation during under-frequency conditions in emergencies.</td>
</tr>
<tr>
<td>3 Short Circuit Strength Requirement</td>
<td>Ensure the strength of the system to enable the stable integration of all inverter-based resources (IBRs) within a portfolio.</td>
<td>The retirement of synchronous generators within utility footprint and replacements with increasing levels of inverter-based resources will lower the short circuit strength of the system. Resources than can operate at lower levels of short circuit ratio (SCR) and those that provide higher short circuit current provide a better future proofing without the need for expensive mitigation measures.</td>
</tr>
<tr>
<td>4 Power Quality (Flicker)</td>
<td>The &quot;stiffness of the grid&quot; affect the sensitivity of grid voltages to the intermittency of renewable resources. Ensuring the grid can deliver power quality in accordance with IEEE standards is essential.</td>
<td>Retirement of large thermal generation plants lower the strength of the grid and increases its susceptibility to voltage flicker due to intermittency of renewable resources, unless properly assessed and mitigated.</td>
</tr>
<tr>
<td>5 Blackstart</td>
<td>Ensure that resources have the ability to be started without support from the wider system or are designed to remain energized without connection to the remainder of the system, with the ability to energize a bus, supply real and reactive power, frequency and voltage control</td>
<td>In the event of a black out condition, utility must have a blackstart plan to restore its local electric system. The plan should demonstrate the ability to energize a cranking path to start large flexible resources with sufficient energy reservoir.</td>
</tr>
<tr>
<td>6 Dynamic VAR Support</td>
<td>Customer equipment driven by induction motors (e.g., air conditioning or factories) requires dynamic reactive power after a grid fault to avoid stalling. The ability of portfolio resources to provide this service depends on their closeness to the load centers.</td>
<td>Utility must retain resources electrically close to load centers to provide this attribute in accordance with NERC and IEEE Standards</td>
</tr>
<tr>
<td>Metric</td>
<td>Description</td>
<td>Rationale</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>7 Dispatchability and Automatic Generation Control</td>
<td>Resources should respond to directives from system operators regarding their status, output, and timing. Resources that can be ramped up and down automatically to respond immediately to changes in the system contribute more to reliability than resources which can be ramped only up or only down, and those in turn are better than ones that cannot be ramped.</td>
<td>Ability to control frequency is paramount to stability of the electric system and the quality of power delivered to customers. Control centers (regional or local) provide dispatch signals under normal conditions, and under emergency restoration procedures or other operational considerations.</td>
</tr>
<tr>
<td>8 Predictability and Firmness of Supply</td>
<td>Ability to predict/forecast the output of resources and to counteract forecast errors.</td>
<td>The ability to predict resource output from a day-ahead to real-time is advantageous to minimize the need for spinning reserves. In places with an active energy market, energy is scheduled with the market in the day-ahead hourly market and in the real-time 5-minute market. Deviations from these schedules have financial consequences and thus the ability to accurately forecast the output of a resource up to 38 hours ahead of time for the day-ahead market and 30 minutes for the real time market is advantageous.</td>
</tr>
<tr>
<td>9 Geographic Location Relative to Load (Resilience)</td>
<td>Ensure the ability to have redundant power evacuation or deliverability paths from resources. Preferrable to locate resources at substations with easy access to multiple high voltage paths, unrestricted fuel supply infrastructure, and close to major load centers.</td>
<td>Location provides economic value in the form of reduced losses, congestion, curtailment risk, and address local capacity requirements. Additionally, from a reliability perspective, resources that are interconnected to buses with multiple power evacuation paths and those close to load centers are more resilient to transmission system outages and provide better assistance in the blackstart restoration process.</td>
</tr>
</tbody>
</table>
## Scoring Criteria Thresholds (1/2)

<table>
<thead>
<tr>
<th>Year 2031</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Energy Adequacy</td>
<td>1 (Pass)</td>
<td>2 (Caution)</td>
</tr>
<tr>
<td></td>
<td>Loss of Load Hours (LOLH) - normal system, 50/50 forecast</td>
<td>&lt;2.4 hrs</td>
<td>2.4-4.8 hrs</td>
</tr>
<tr>
<td></td>
<td>Expected Energy not Served (GWh) - normal system 50/50 fcst</td>
<td>&lt;2.4*Peak</td>
<td>2.4-4.8*Peak</td>
</tr>
<tr>
<td></td>
<td>max MW Short (MW) - normal system 50/50 forecast</td>
<td>&lt;90%</td>
<td>90-110%</td>
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<tr>
<td></td>
<td>max MW Short - loss of 50% of tieline capacity, 50/50 fcst</td>
<td>&lt;45%</td>
<td>45-55%</td>
</tr>
<tr>
<td></td>
<td>max MW Short (islanded, 50/50 forecast)</td>
<td>&lt;70%</td>
<td>70-85%</td>
</tr>
<tr>
<td></td>
<td>max MW Short (normal system, 90/10 forecast)</td>
<td>&lt;5%</td>
<td>5-20%</td>
</tr>
<tr>
<td>2</td>
<td>Operational Flexibility and Frequency Support</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Inertia MVA-s</td>
<td>&gt;4.2 *Peak</td>
<td>2.6-4.2 *Peak</td>
</tr>
<tr>
<td></td>
<td>Inertial Gap FFR MW (% CAP)</td>
<td>0</td>
<td>0-10% of CAP</td>
</tr>
<tr>
<td></td>
<td>Primary Gap PFR MW (% CAP)</td>
<td>0</td>
<td>0-2% of CAP</td>
</tr>
<tr>
<td>3</td>
<td>Short Circuit Strength</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Inverter MWs passing ESCR limits (%) - Connected System</td>
<td>95%</td>
<td>80-95%</td>
</tr>
<tr>
<td></td>
<td>Inverter MWs passing ESCR limits (%) - Islanded System</td>
<td>80%</td>
<td>50-80%</td>
</tr>
<tr>
<td></td>
<td>Required Additional Synch Condensers MVA (% peak load) - Connected</td>
<td>0</td>
<td>0-500</td>
</tr>
<tr>
<td></td>
<td>Required Additional Synch Condensers MVA (% peak load) - Islanded</td>
<td>0</td>
<td>0-500</td>
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</table>
### Scoring Criteria Thresholds (2/2)

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<tr>
<th>Year 2031</th>
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<th></th>
<th></th>
<th>Rationale</th>
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</thead>
<tbody>
<tr>
<td><strong>Flicker</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Pass)</td>
<td>(Caution)</td>
<td>(Problem)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Compliance with Flicker limits when Connected (GE Flicker Curve or IEC Flicker Meter)</td>
<td>&gt;95%</td>
<td>80-95%</td>
<td>&lt;80%</td>
</tr>
<tr>
<td></td>
<td>Compliance with Flicker limits when Islanded</td>
<td>&gt;80%</td>
<td>50-80%</td>
<td>&lt;50%</td>
</tr>
<tr>
<td></td>
<td>Required Synchronous Condensers MVA to mitigate Flicker</td>
<td>0%</td>
<td>0-500</td>
<td>&gt;500</td>
</tr>
<tr>
<td><strong>Blackstart</strong></td>
<td></td>
<td></td>
<td></td>
<td>System requires real and reactive power sources with sufficient rating and duration to start other resources. Higher rated resources lower the risk</td>
</tr>
<tr>
<td><strong>Dynamic VAR Support</strong></td>
<td></td>
<td></td>
<td></td>
<td>Dynamic reactive power (DRP) should exceed 55-85% of the peak load served by the load centers. DRP requirement to prevent induction motor stalling is 2.5x the steady state reactive consumption. Assuming a PF=0.9, and Induction motors account for 50-80% of the load. Assume that only 20% of the load can experience a common voltage event.</td>
</tr>
<tr>
<td><strong>Dispatchability</strong></td>
<td></td>
<td></td>
<td></td>
<td>Dispatchable resource are essential for system operation</td>
</tr>
<tr>
<td></td>
<td>Dispatchable (%CAP)</td>
<td>&gt;60%</td>
<td>50-60%</td>
<td>&lt;50%</td>
</tr>
<tr>
<td></td>
<td>Unavoidable VER Penetration %</td>
<td>&lt;60%</td>
<td>60-70%</td>
<td>&gt;70%</td>
</tr>
<tr>
<td></td>
<td>Increased Freq Regulation Requirements (% Peak Load)</td>
<td>&lt;2% of peak load</td>
<td>2-3% of Peak Load</td>
<td>&gt;3% of peak load</td>
</tr>
<tr>
<td></td>
<td>1-min Ramp Capability (MW)</td>
<td>&gt;15% of CAP</td>
<td>10-15% of CAP</td>
<td>&lt;10% of CAP</td>
</tr>
<tr>
<td></td>
<td>10-min Ramp Capability (MW)</td>
<td>&gt;65% of CAP</td>
<td>50-65% of CAP</td>
<td>&lt;50% of CAP</td>
</tr>
<tr>
<td><strong>Predictability and Firmness</strong></td>
<td></td>
<td></td>
<td></td>
<td>Excess ramping capability to offset higher levels of intermittent resource output variability is desired</td>
</tr>
<tr>
<td></td>
<td>Ramping Capability to Mitigate Forecast Errors (+Excess/-Deficit) (%VER MW)</td>
<td>≥ 0</td>
<td>-10% - 0% of CAP</td>
<td>&lt;10% of CAP</td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td></td>
<td></td>
<td></td>
<td>More power evacuation paths increase system resilience</td>
</tr>
<tr>
<td></td>
<td>Average Number of Evacuation Paths</td>
<td>&gt;3</td>
<td>2-3</td>
<td>&lt;2</td>
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Scorecard – Portfolio Scores

<table>
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<tr>
<th>Year 2031</th>
<th>Status Quo</th>
<th>Refuel</th>
<th>1 Retire</th>
<th>2 Retire</th>
<th>Clean</th>
<th>Optimize</th>
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<tbody>
<tr>
<td><strong>1</strong> Energy Adequacy</td>
<td>Loss of Load Hours (LOLH) - normal system, 50/50 forecast</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
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<tr>
<td></td>
<td>Expected Energy not Served (GWh) - normal system 50/50 fcs</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>max MW Short (MW) - normal system 50/50 forecast</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<td></td>
<td>max MW Short - loss of 50% of tieline capacity, 50/50 fcs</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1/2</td>
<td>0</td>
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<td></td>
<td>max MW Short (islanded, 50/50 forecast)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<tr>
<td></td>
<td>max MW Short (normal system, 90/10 forecast)</td>
<td>1/2</td>
<td>1/2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>2</strong> Operational Flexibility and Frequency Support</td>
<td>Inertia MVA-s</td>
<td>1/2</td>
<td>1/2</td>
<td>1/2</td>
<td>1/2</td>
<td>1/2</td>
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<tr>
<td></td>
<td>Inertial Gap FFR MW (% CAP)</td>
<td>1/2</td>
<td>1/2</td>
<td>1/2</td>
<td>1/2</td>
<td>1/2</td>
</tr>
<tr>
<td></td>
<td>Primary Gap PFR MW (% CAP)</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>3</strong> Short Circuit Strength</td>
<td>Inverter MWs passing ESCR limits (%) - Connected System</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Inverter MWs passing ESCR limits (%) - Islanded System</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1/2</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Required Additional Synch Condensers MVA (when Connected)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Required Additional Synch Condensers MVA (when Islanded)</td>
<td>1</td>
<td>1</td>
<td>1/2</td>
<td>1/2</td>
<td>0</td>
</tr>
<tr>
<td><strong>4</strong> Power Quality</td>
<td>Compliance with Flicker limits when Connected (GE Flicker Curve or IEC Flicker Meter)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Compliance with Flicker limits when Islanded</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Required Synchronous Condensers MVA to mitigate Flicker</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<tr>
<td><strong>5</strong> Blackstart</td>
<td>Qualitative Assessment of Ability to Blackstart the system</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<tr>
<td><strong>6</strong> Dynamic VAR Support</td>
<td>Dynamic VAR to load Center Capability (% of Peak Load)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>7</strong> Dispatchability and Automatic Generation Control</td>
<td>Dispatchable (%CAP)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Unavoidable VER Penetration %</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Increased Freq Regulation Requirements (% Peak Load)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1-min Ramp Capability (MW)</td>
<td>1/2</td>
<td>1/2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>10-min Ramp Capability (MW)</td>
<td>0</td>
<td>0</td>
<td>1/2</td>
<td>1/2</td>
<td>1/2</td>
</tr>
<tr>
<td><strong>8</strong> Predictability and Firmness</td>
<td>Ramping Capability to Mitigate Forecast Errors (+Excess/-Deficit) (%VER MW)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>9</strong> Location</td>
<td>Average Number of Evacuation Paths</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Cumulative score (out of possible 9) | 7.95 | 7.95 | 7.86 | 7.90 | 7.57 | 7.95 |
## Mitigations

<table>
<thead>
<tr>
<th>Current Trends</th>
<th>Status Quo</th>
<th>Refuel</th>
<th>1 Retire</th>
<th>2 Retire</th>
<th>Clean</th>
<th>Optimize</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equip Stand-alone ESS with GFM inverters (MW)</td>
<td>129</td>
<td>99</td>
<td>183</td>
<td>49</td>
<td>128</td>
<td>98</td>
</tr>
<tr>
<td>Additional Synchronous Condensers (MVA)</td>
<td>0</td>
<td>0</td>
<td>350</td>
<td>300</td>
<td>1500</td>
<td>0</td>
</tr>
<tr>
<td>Additional Power Mitigations (MW)</td>
<td>298</td>
<td>326</td>
<td>183</td>
<td>49</td>
<td>128</td>
<td>325</td>
</tr>
<tr>
<td>Increased Freq Regulation</td>
<td>39</td>
<td>48</td>
<td>49</td>
<td>45</td>
<td>66</td>
<td>47</td>
</tr>
<tr>
<td>Address Inertial Response Gaps</td>
<td>129</td>
<td>99</td>
<td>183</td>
<td>49</td>
<td>128</td>
<td>98</td>
</tr>
<tr>
<td>Address Primary Response Gaps</td>
<td>298</td>
<td>326</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>325</td>
</tr>
<tr>
<td>Firm up Intermittent Renewable Forecast</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Thank you!

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San Clemente, CA 92673

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IRP Scorecard Results

Erik Miller, Manager, Resource Planning, AES Indiana
What is a Preferred Resource Portfolio?

"Preferred resource portfolio’ means the utility’s selected long term supply-side and demand-side resource mix that safely, reliably, efficiently, and cost-effectively meets the electric system demand, taking cost, risk, and uncertainty into consideration.”

Integrated Resource Plan (IRP) in Indiana → 170 IAC 4-7-2
- 20-year look at how AES Indiana will serve load
- Submitted every three years
- Plan created with stakeholder input
- Modeling and analysis culminates in a preferred resource portfolio and a short-term action plan

Stakeholders are critical to the process

AES Indiana has been committed to providing an engaging and collaborative IRP process for its stakeholders:
- Five Public Advisory Meetings for stakeholders to engage throughout the process
- Five Technical Meetings available to stakeholders with nondisclosure agreements (NDA) for deeper analytics discussion
- Additional ad hoc meetings to review comments and questions from stakeholders with NDAs
- Planning documents and modeling materials were shared with stakeholders with NDAs including Encompass model database
- The Preferred Resource Portfolio was determined after full consideration of stakeholder input

## Final IRP Scorecard Results

<table>
<thead>
<tr>
<th>Affordability</th>
<th>Environmental Sustainability</th>
<th>Reliability, Stability &amp; Resiliency</th>
<th>Risk &amp; Opportunity</th>
<th>Economic Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present Value of Revenue Requirements ($000,000)</td>
<td>Total portfolio CO₂ Emissions (mmtons)</td>
<td>Total portfolio NO₂ Emissions (tons)</td>
<td>Water Use (mngal)</td>
<td>CCP (tons)</td>
</tr>
</tbody>
</table>

1. **2022 IRP Strategies**
   - 1. No Early Retirement
   - 2. Pete Refuel to 100% Natural Gas (est. 2025)
   - 3. One Pete Unit Retires in 2026
   - 4. Both Pete Units Retire in 2026 & 2028
   - 5. “Clean Energy Strategy” – Both Pete Units Retire and replaced with Renewables in 2026 & 2028
   - 6. Encompass Optimization without Predefined Strategy – Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

### Table Data

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Present Value of Revenue Requirements ($000,000)</th>
<th>Total portfolio CO₂ Emissions (mmtons)</th>
<th>Total portfolio NO₂ Emissions (tons)</th>
<th>Water Use (mngal)</th>
<th>CCP (tons)</th>
<th>% Renewable Energy in 2032</th>
<th>Composite score from Reliability Analysis</th>
<th>Lowest PVRR across policy scenarios ($000,000)</th>
<th>Highest PVRR across policy scenarios ($000,000)</th>
<th>PS (Mean - PS)</th>
<th>P95 (P95 – Mean)</th>
<th>20-year avg sales + purchases (GWh)</th>
<th>Portfolio PVRR w/ low renewable cost ($000,000)</th>
<th>Portfolio PVRR w/ high renewable cost ($000,000)</th>
<th>Total change in FTEs associated with generation 2023 - 2042</th>
<th>Total amount of property tax paid from AES IN assets ($000,000)</th>
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<tbody>
<tr>
<td>1</td>
<td>$ 9,572</td>
<td>101.9</td>
<td>64,991</td>
<td>45,605</td>
<td>36.7</td>
<td>6,611</td>
<td>45%</td>
<td>7.95</td>
<td>8,860</td>
<td>11,259</td>
<td>$ 9,271 [-$264]</td>
<td>$ 9,840 ($305)</td>
<td>5,291</td>
<td>$ 9,080</td>
<td>$ 10,157</td>
<td>222</td>
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<td>2</td>
<td>$ 9,330</td>
<td>72.5</td>
<td>13,513</td>
<td>22,146</td>
<td>7.9</td>
<td>1,417</td>
<td>55%</td>
<td>7.95</td>
<td>8,564</td>
<td>11,329</td>
<td>$ 9,030 [-$334]</td>
<td>$ 9,746 ($382)</td>
<td>5,222</td>
<td>$ 8,763</td>
<td>$ 9,999</td>
<td>99</td>
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<tr>
<td>3</td>
<td>$ 9,773</td>
<td>88.1</td>
<td>45,544</td>
<td>42,042</td>
<td>26.7</td>
<td>4,813</td>
<td>52%</td>
<td>7.86</td>
<td>9,288</td>
<td>11,462</td>
<td>$ 9,608 [-$284]</td>
<td>$ 10,237 ($336)</td>
<td>5,737</td>
<td>$ 9,244</td>
<td>$ 10,406</td>
<td>195</td>
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<tr>
<td>4</td>
<td>$ 9,618</td>
<td>79.5</td>
<td>25,649</td>
<td>24,932</td>
<td>15.0</td>
<td>2,700</td>
<td>48%</td>
<td>7.90</td>
<td>9,135</td>
<td>11,392</td>
<td>$ 9,295 [-$287]</td>
<td>$ 9,903 ($321)</td>
<td>5,512</td>
<td>$ 9,104</td>
<td>$ 10,149</td>
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<td>5</td>
<td>$ 9,711</td>
<td>69.8</td>
<td>25,383</td>
<td>24,881</td>
<td>14.8</td>
<td>2,676</td>
<td>64%</td>
<td>7.57</td>
<td>9,590</td>
<td>11,275</td>
<td>$ 9,447 [-$280]</td>
<td>$ 10,039 ($312)</td>
<td>6,088</td>
<td>$ 9,017</td>
<td>$ 10,442</td>
<td>55</td>
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<tr>
<td>6</td>
<td>$ 9,262</td>
<td>76.1</td>
<td>18,622</td>
<td>25,645</td>
<td>10.9</td>
<td>1,970</td>
<td>54%</td>
<td>7.95</td>
<td>8,517</td>
<td>11,126</td>
<td>$ 8,952 [-$324]</td>
<td>$ 9,629 ($352)</td>
<td>5,136</td>
<td>$ 8,730</td>
<td>$ 9,099</td>
<td>88</td>
</tr>
</tbody>
</table>
Opportunities for our people

CONVERSION
→ Jobs to support the conversion from coal to natural gas

RENEWABLES
→ Jobs to support new renewables added on-site

TRANSMISSION AND DISTRIBUTION
→ Jobs to maintain transmission and distribution

CONSTRUCTION
→ Jobs to build and expand infrastructure

New opportunities and continued economic impact
Preferred Resource Portfolio & Short-Term Action Plan

Erik Miller, Manager, Resource Planning, AES Indiana
Preferred Resource Portfolio

Convert Petersburg Coal Units 3 & 4 to Natural Gas in 2025 and add up to ~1,300 MW of wind, solar and storage by 2027

Affordability
→ Provides the least cost to customers over the 20-year planning horizon by lowering the fixed cost at Petersburg through the economic conversion of the remaining Petersburg units from coal to natural gas.
→ Demonstrates lowest annual PVRR relative to other portfolios over the 20-year planning horizon.

Environmental Sustainability
→ Delivers the quickest exit from coal-fired generation (in 2025) which provides the lowest 20-year AES Indiana generation portfolio emissions for SO2, NOx, water use and coal combustion products, and the second lowest emissions for CO2.

Reliability, Stability & Resiliency
→ Offers 1-for-1 replacement dispatchable capacity (UCAP) for Petersburg that economically and effectively delivers in meeting MISO’s Seasonal Resource Adequacy Construct.
→ Provides firm unforced capacity when needed which will allow AES Indiana to responsibly and gradually transition to renewable energy resources over the planning horizon.
→ Demonstrates the highest composite reliability score while still delivering significant renewable generation investment.
Convert Petersburg Coal Units 3 & 4 to Natural Gas in 2025 and add up to ~1,300 MW of wind, solar and storage by 2027

Risk & Opportunity
→ Provides best general performance across risk and opportunity metrics.

Economic Impact
→ Continues to contribute economically to the Petersburg community by leveraging existing infrastructure and maintaining operation of the Petersburg Generating Station as a gas resource and hub for renewable resources.
Preferred Resource Portfolio

Convert Petersburg Coal Units 3 & 4 to Natural Gas in 2025 and build ~1,300 MW of renewables by 2027

Short-Term Action Plan

2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043

REPLACEMENTS

2025
- 240 MW New Battery Energy Storage at Petersburg

2025-2027
- 550 – 1,065 MW of new Wind and Solar

2025
- 1,052 MW Natural Gas Conversion – Petersburg Units 3 & 4

2030-2034
- 450 MW New Solar + Storage

2031-2034
- 300 MW New Wind

2031-2034
- 1,450 MW New Solar

2031
- Age-based Retirement 198 MW Natural Gas – Harding Street Units ST5 & ST6

2034
- Age-based Retirement 420 MW Natural Gas – Harding Street Units ST7

Natural Gas

Renewables
Winter capacity position after converting Petersburg to Natural Gas

Pete Conversion to 100% Natural Gas (est. 2025)

- Refueling Units 3 & 4 provides 1-for-1 dispatchable replacement of the existing coal units.
- AES Indiana still has a capacity need (~240 MW) in the winter under MISO’s new seasonal construct with high winter reserve margin.
- Company to fill the remaining capacity need with renewable generation based on model results.
Short-Term Action Plan: 2023-2027

Convert Petersburg Coal Units 3 & 4 to Natural Gas in 2025 and add up to ~1,300 MW of wind, solar and storage by 2027

AES Indiana’s short-term action plan balances reliability, affordability and sustainability by:

→ Ceasing coal-fired generation in 2025 after converting Petersburg Units 3 and 4 to natural gas
→ Adding up to 1,300 MW of renewable generation for capacity and energy, which includes:
  → 240 MW ICAP of battery energy storage at Petersburg to fill winter capacity position in 2025
  → 550 – 1,065 MW ICAP of wind and solar as energy replacement for Petersburg based on results from the base and low Replacement Resource Capital Cost Sensitivity Analysis
→ Implementing three-year DSM action plan that targets an annual average of 130,000 – 134,000 MWh of energy efficiency (approximately 1.1% of 2021 sales) and three-year total of 75 MW summer peak impacts of demand response

Pete Conversion Strategy using Base Replacement Resource Costs (presented in MW ICAP)

<table>
<thead>
<tr>
<th>Replacements</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pete Conversion to Natural Gas</td>
<td>0</td>
<td>0</td>
<td>1052</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Wind</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>50</td>
<td>450</td>
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<tr>
<td>Solar</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Storage</td>
<td>0</td>
<td>0</td>
<td>240</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Solar + Storage</td>
<td>0</td>
<td>0</td>
<td>45</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Pete Conversion Strategy using Low Replacement Resource Costs (presented in MW ICAP)

<table>
<thead>
<tr>
<th>Replacements</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pete Conversion to Natural Gas</td>
<td>0</td>
<td>0</td>
<td>1052</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Wind</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>200</td>
<td>700</td>
</tr>
<tr>
<td>Solar</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>75</td>
<td>0</td>
</tr>
<tr>
<td>Storage</td>
<td>0</td>
<td>0</td>
<td>240</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Solar + Storage</td>
<td>0</td>
<td>0</td>
<td>90</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

AES Indiana plans to procure a range of renewables as energy replacement for Petersburg based on results from the Base and Low Replacement Resource Capital Cost Sensitivity Analysis. If renewables can be procured at a cost closer to the low-cost sensitivity, then AES Indiana will pursue a quantity consistent with the low sensitivity.
## DSM Results

### Energy Efficiency:

<table>
<thead>
<tr>
<th>Vintage 1</th>
<th>Vintage 2</th>
<th>Vintage 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>2024 – 2026</td>
<td>2027 – 2029</td>
<td>2030 – 2042</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Residential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficient Products - Lower Cost</td>
</tr>
<tr>
<td>Efficient Products - Higher Cost</td>
</tr>
<tr>
<td>Behavioral</td>
</tr>
<tr>
<td>School Education</td>
</tr>
<tr>
<td>Appliance Recycling</td>
</tr>
<tr>
<td>Multifamily</td>
</tr>
<tr>
<td>IQW</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C&amp;I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prescriptive</td>
</tr>
<tr>
<td>Custom</td>
</tr>
<tr>
<td>Custom RCx</td>
</tr>
<tr>
<td>Custom SEM</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg Annual MWh</td>
</tr>
<tr>
<td>131,578 - 134,263</td>
</tr>
<tr>
<td>141,526</td>
</tr>
<tr>
<td>146,428</td>
</tr>
</tbody>
</table>

| % of 2021 Sales ex. Opt-Out |
| 1 - 1.1% |
| 1.1% |
| 1.2% |

| Cumulative Summer MW |
| 87 - 89 MW |
| 92 MW |
| 303 MW |

### Demand Response:

<table>
<thead>
<tr>
<th>2026 – 2042</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Load Control</td>
</tr>
</tbody>
</table>

| Residential Rates |

| C&I Rates |

| Cumulative Summer MW |
| 75 MW |

**Note:** Boxes highlighted in purple denote DSM bundles that were selected by Encompass
## Affordability

*Petersburg conversion to natural gas provides the lowest 20-yr PVRR and low PVRR volatility over the planning period*

### 20-yr PVRR

<table>
<thead>
<tr>
<th></th>
<th>Present Value of Revenue Requirements (2023 $000,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$9,572</td>
</tr>
<tr>
<td>2</td>
<td>$9,330</td>
</tr>
<tr>
<td>3</td>
<td>$9,773</td>
</tr>
<tr>
<td>4</td>
<td>$9,618</td>
</tr>
<tr>
<td>5</td>
<td>$9,711</td>
</tr>
<tr>
<td>6</td>
<td>$9,262</td>
</tr>
</tbody>
</table>

### Compared to the No Retirement (“Status Quo”) Scenario

- **Strategies**
  1. No Early Retirement
  2. Pete Refuel to 100% Natural Gas (est. 2025)
  3. One Pete Unit Retires in 2026
  4. Both Pete Units Retire in 2026 & 2028
  5. “Clean Energy Strategy” – Both Pete Units Retire and replaced with Renewables in 2026 & 2028

*Petersburg conversion to natural gas provides the lowest 20-yr PVRR and low PVRR volatility over the planning period*

---

2022 IRP Report Attachment 1-2

Page 628 of 647
Sustainability

Emissions Comparison – Petersburg Conversion vs Clean Energy Strategy

Petersburg Conversion to Natural Gas provides fastest exit from coal and as a result comparatively low emissions

### CO2 mmTons

<table>
<thead>
<tr>
<th>Year Range</th>
<th>Pete Conversion</th>
<th>Clean Energy Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>2023 - 2032</td>
<td>54</td>
<td>55</td>
</tr>
<tr>
<td>2023 - 2042</td>
<td>73</td>
<td>70</td>
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</tbody>
</table>

### SO2 Tons

<table>
<thead>
<tr>
<th>Year Range</th>
<th>Pete Conversion</th>
<th>Clean Energy Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>2023 - 2032</td>
<td>13,402</td>
<td>25,254</td>
</tr>
<tr>
<td>2023 - 2042</td>
<td>13,513</td>
<td>25,383</td>
</tr>
</tbody>
</table>

### NOx Tons

<table>
<thead>
<tr>
<th>Year Range</th>
<th>Pete Conversion</th>
<th>Clean Energy Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>2023 - 2032</td>
<td>19,501</td>
<td>23,303</td>
</tr>
<tr>
<td>2023 - 2042</td>
<td>22,146</td>
<td>24,881</td>
</tr>
</tbody>
</table>
Converting Petersburg Units 3 & 4 to natural gas effectively reduces CO2 emissions due to a low-capacity factor of Pete on natural gas combined with significant investment in renewables.

AES Indiana will achieve a 69% reduction in CO2 emissions by 2030 compared to 2018 levels.
<table>
<thead>
<tr>
<th>City of Indianapolis Recommendations</th>
<th>AES Indiana Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>The City of Indianapolis seeks a resource mix with renewable generation capacity that aligns with the goals of the City and community. City recommends AES Indiana develop a model with multiple scenarios that achieve a 62.8% reduction over 2018 emissions levels, in order to align with the City's Science Based Target's for 2030.</td>
<td>AES Indiana's Preferred Resource Portfolio achieves a 69% reduction in CO2 emissions in 2030 compared to 2018 levels. The portfolio provides affordable, reliable and sustainable energy to Indianapolis residents.</td>
</tr>
<tr>
<td>The City of Indianapolis strongly supports AES Indiana's use of “all-source” procurement for future capacity additions to ensure cost-effective, market-driven innovation.</td>
<td>AES Indiana will fill it's need for replacement capacity identified in the Short-Term Action Plan through all-source RFPs. The Company will pursue the most cost effective and viable wind, and storage projects through this process.</td>
</tr>
<tr>
<td>The City of Indianapolis encourages AES Indiana to expand offerings of and access to energy efficiency programs targeting those with the highest energy burden.</td>
<td>AES Indiana has identified energy efficiency as a cost-effective energy resource and will work to develop a new energy efficiency program plan to start in 2024 - 2026. Based on current IRP modeling results we expect our new plan will continue to have an emphasis on programs that provide energy savings to all customers, with added emphasis on programs that benefit low- and moderate-income households.</td>
</tr>
<tr>
<td>The City of Indianapolis encourages AES Indiana to support a Just Transition for each Indiana community.</td>
<td>AES Indiana will continue to invest in new technologies and identify clean energy projects that deliver greener, smarter energy solutions. AES Indiana remains invested in our communities through commitments to the workforce, charitable organizations and economic development. Advanced modeling, additional economic impact metrics, greater transparency with stakeholders and increased accessibility to the IRP process allowed AES Indiana to paint a full picture of the potential impacts of each generation strategy and select a just and inclusive portfolio.</td>
</tr>
<tr>
<td>The City of Indianapolis requests that AES Indiana make energy performance and aggregated whole building data available to customers.</td>
<td>AES Indiana currently offers online tools that provide customers throughout our service territory with access to their energy usage data. These tools also provide recommendations to customers for managing their energy usage and costs through energy efficiency measures and programs. As AES Indiana expects the capabilities of our online tools will evolve to support additional customer friendly features that meet current and future data driven needs such as whole building data aggregation.</td>
</tr>
</tbody>
</table>
# 2022 IRP Key Modeling Solutions

There were several significant events in 2022 that created challenges for IRP modeling.

<table>
<thead>
<tr>
<th>Market Changes</th>
<th>Modeling Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>In 2022, FERC approved MISO’s Seasonal Capacity Construct and MISO’s Capacity Market cleared at CONE (Planning Reserve Auction – PRA)</td>
<td>Modeled a MISO’s Seasonal Capacity Construct and included CONE as the capacity price in all four seasons</td>
</tr>
<tr>
<td>Inflated replacement resource capital costs identified through AES Indiana’s 2022 RFP</td>
<td>Conducted Replacement Resource Sensitivity Analysis with low, base and high capital costs for replacement resources. Analysis optimized portfolios assuming a range of capital costs. Provides for flexibility in executing the Short-Term Action Plan if resources can be procured at a lower cost</td>
</tr>
<tr>
<td>Inflation Reduction Act of 2022 passed into law in August of 2022 which changed the ITC and PTC provisions for renewable resources</td>
<td>Included IRA assumptions in the Current Trends (Reference Case) Scenarios for candidate portfolio evaluation</td>
</tr>
<tr>
<td>Scarcity within the NOx allowance market brought on by uncertainty around CSAPR resulted in historically high NOx prices</td>
<td>Increased NOx price forecast in near-term to reflect current NOx allowance market volatility</td>
</tr>
<tr>
<td>Volatile commodities starting in early 2022 marked by inflated gas and power prices starting Feb/Mar 2022</td>
<td>Updated commodity curves using ICE Forward Curves from May 31, 2022 and Spring 2022 Horizon Fundamental Curves</td>
</tr>
</tbody>
</table>
Future Modeling Enhancements

2022 IPL IRP

→ Focused modeling on viable renewable technologies – wind, solar & storage
→ Conducted hourly dispatch modeling to capture portfolio PVRR
→ Distribution System Planning analysis that assessed system constraints from emerging technologies
→ Captured appropriate resource accreditation for non-dispatchable generation based on MISO guidance

Consideration for Future IRPs

→ Model alternative replacement resource options such as hydrogen or SMRs if commercially viable
→ Sub-hourly modeling to capture additional PVRR benefits including ancillary services value of battery energy storage and reciprocating engines
→ Enhanced Distribution System Planning that captures circuit-level value of distributed generation and DSM
→ Include refinements made to non-dispatchable resource seasonal capacity credit such as seasonal ELCC
AES Indiana invites the public and stakeholders to provide feedback on the IRP process.

Your responses will help AES Indiana ensure the 2022 IRP reflects a meaningful, objective look at our shared energy future.

Input from this survey will be reviewed by members of the IRP team in advance of the final IRP report filing on or before Dec. 1, 2022, and to improve future IRPs.

Your participation in this survey is confidential and completely voluntary.

Responses will be collected until Nov. 13, 2022.

The survey link will be shared in the chat.
Final Q&A and Next Steps
Public Advisory Meeting

- All meetings were made available for attendance via Teams.
- A Technical Meeting was held the week preceding each Public Advisory Meeting for stakeholders with nondisclosure agreements. Tech Meeting topics focused on those anticipated at the proceeding Public Advisory Meeting.
- IRP Report will be filed with the IURC December 1, 2022
Thank You
Appendix
Converting Petersburg to natural gas results in significant drop in capacity factor that continues over the planning period.
Quanta Analysis - Appendix 1

All Portfolios
### Resource Portfolios

#### Summer Capacity (MW)

<table>
<thead>
<tr>
<th>Year</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disp %</td>
<td>43</td>
<td>42</td>
<td>38</td>
</tr>
<tr>
<td>S&amp;W %</td>
<td>54</td>
<td>56</td>
<td>56</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Disp</th>
<th>43</th>
<th>42</th>
<th>38</th>
<th>38</th>
<th>39</th>
</tr>
</thead>
<tbody>
<tr>
<td>S&amp;W</td>
<td>54</td>
<td>56</td>
<td>56</td>
<td>59</td>
<td>59</td>
</tr>
</tbody>
</table>

#### Portfolio Breakdown

- **Aggressive Environmental**
- **Current Trends**
- **Decarbonization**
- **No Environmental**

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Refuel</th>
<th>Retire</th>
<th>Clean</th>
<th>Optimize</th>
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<tbody>
<tr>
<td>Storage</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>EE</td>
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<td>DR</td>
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</tr>
<tr>
<td>Wind</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>BTM-Solar</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>S+S</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Solar</td>
<td></td>
<td></td>
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<td>GT</td>
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</tr>
<tr>
<td>Steam</td>
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</tr>
<tr>
<td>Coal</td>
<td></td>
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</tr>
<tr>
<td>9% S+W</td>
<td></td>
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</tbody>
</table>

### Portfolio Analysis

- **Storage**
- **EE**
- **DR**
- **Wind**
- **BTM-Solar**
- **S+S**
- **Solar**
- **CC**
- **GT**
- **Steam**
- **Coal**
- **9% S+W**

---

**AES Indiana 2022 IRP Report**

Attachment 1-2

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## Portfolio Resources

### Y2031 - All Resources

<table>
<thead>
<tr>
<th></th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
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<th>T21</th>
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<th>T23</th>
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<tr>
<td>ICAP (MW) - Total</td>
<td>7,106</td>
<td>7,333</td>
<td>7,296</td>
<td>7,322</td>
<td>7,322</td>
<td>7,220</td>
<td>5,325</td>
<td>5,676</td>
<td>5,696</td>
<td>5,460</td>
<td>6,170</td>
<td>5,617</td>
<td>5,499</td>
<td>5,676</td>
<td>5,417</td>
<td>5,422</td>
<td>5,902</td>
<td>5,700</td>
<td>4,247</td>
<td>4,259</td>
<td>4,229</td>
<td>4,203</td>
<td>4,142</td>
<td>4,260</td>
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</table>

### Conventional (MW)

|            | 2,604 | 2,616 | 2,084 | 1,564 | 1,564 | 2,090 | 2,604 | 2,616 | 2,084 | 1,889 | 1,564 | 2,616 | 2,604 | 2,616 | 2,084 | 1,889 | 1,564 | 2,616 | 2,929 | 2,941 | 2,490 | 2,214 | 1,564 | 2,941 |

### Intermittent (MW)


### Storage (MW)

|            | 333 | 345 | 785 | 1,013 | 1,013 | 553 | 333 | 313 | 840 | 920 | 1,180 | 313 | 393 | 333 | 813 | 1,013 | 1,293 | 333 | 240 | 240 | 680 | 820 | 1,280 | 240 |

### % Renewable Penetration

- Conventional: 70%
- Intermittent: 54%

### % Intermittent

- Conventional: 60%
- Intermittent: 50%
AES Indiana
2022 IRP Report
Attachment 1-2
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Scorecard – Portfolio Scores
Quo
T1

Year 2031

1

2

3

4

Energy Adequacy

Power Quality

Quo
T7

Current Trends
Refuel 1 Retire 2 Retire Clean Optimiz
T8
T9
T10
T11
T12

Quo
T13

Decarbonization
Refuel 1 Retire 2 Retire Clean Optimiz
T14
T15
T16
T17
T18

Quo
T19

No Environmental
Refuel 1 Retire 2 Retire Clean Optimiz
T20
T21
T22
T23
T24

Loss of Load Hours (LOLH) - normal system, 50/50 forecast

1

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Expected Energy not Served (GWh) - normal system 50/50 fcst

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max MW Short (MW) - normal system 50/50 forecast

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max MW Short - loss of 50% of tieline capacity, 50/50 fcst

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1/2

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Inverter MWs passing ESCR limits (%) - Islanded System

0

0

0

0

0

0

1

1

0

1/2

0

1

1

1

1/2

1/2

0

1

1

1

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1

1

Required Additional Synch Condensers MVA (when Connected)

1

1

1

1

1

1

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1

1

1

1

1

1

1

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1

Required Additional Synch Condensers MVA (when Islanded)

0

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0

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1/2

1/2

0

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1/2

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1

Compliance with Flicker limits when Connected
(GE Flicker Curve or IEC Flicker Meter)

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Compliance with Flicker limits when Islanded

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1

Required Synchronous Condensers MVA to mitigate Flicker

1

1

1

1/2

1/2

1

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1

max MW Short (islanded, 50/50 forecast)
max MW Short (normal system, 90/10 forecast)
Inertia MVA-s
Operational Flexibility
Inertial Gap FFR MW (% CAP)
and Frequency Support
Primary Gap PFR MW (% CAP)
Inverter MWs passing ESCR limits (%) - Connected System
Short Circuit Strength

Aggressive Environmental
Refuel 1 Retire 2 Retire Clean Optimiz
T2
T3
T4
T5
T6

5

Blackstart

Qualitative Assessment of Ability to Blackstart the system

1

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6

Dynamic VAR Support Dynamic VAR to load Center Capability (% of Peak Load)

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1

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Dispatchable (%CAP)
Unavoidable VER Penetration %

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Increased Freq Regulation Requirements (% Peak Load)

1

1

1

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1

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1

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1

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1

1-min Ramp Capability (MW)
10-min Ramp Capability (MW)

1/2
0

1/2
0

1
0

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1/2

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1/2
0

7

Dispatchability and
Automatic Generation
Control

8

Predictability and
Firmness

Ramping Capability to Mitigate Forecast Errors (+Excess/-Deficit) (%VER MW)

1/2

1/2

1

1

1

1

1

1

1

1

1

1

1

1

1

1

1

1

1

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9

Location

Average Number of Evacuation Paths

1

1

1

1

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1

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1

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4
5
6
7
8
9

Energy Adequacy
Dispatchability and Automatic Generation Control
Operational Flexibility and Frequency Support
Predictability and Firmness
Short Circuit Strength
Dynamic VAR Support
Location
Power Quality
Blackstart

0.92
0.70
0.33
0.50
0.50
1.00
1.00
1.00
1.00

0.92
0.70
0.33
0.50
0.50
1.00
1.00
1.00
1.00

0.83
0.80
0.67
1.00
0.50
1.00
1.00
1.00
1.00

0.50
0.90
0.67
1.00
0.50
1.00
1.00
0.67
1.00

0.50
0.90
0.67
1.00
0.50
1.00
1.00
0.67
1.00

0.83
0.80
0.33
1.00
0.50
1.00
1.00
1.00
1.00

0.92
0.70
0.33
1.00
1.00
1.00
1.00
1.00
1.00

0.92
0.70
0.33
1.00
1.00
1.00
1.00
1.00
1.00

0.67
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0.67
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0.63
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1.00
1.00

0.58
0.90
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0.75
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1.00
1.00
1.00

0.50
0.90
0.67
1.00
0.50
1.00
1.00
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0.92
0.70
0.33
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0.92
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0.67
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0.92
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0.92
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0.92
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1.00

Cumulative Score (out of possible 9) 6.95

6.95

7.80

7.23

7.23

7.47

7.95

7.95

7.86

7.90

7.57

7.95

7.95

7.95

7.98

8.23

7.67

7.95

8.12

8.12

8.40

8.40

8.17

8.12

77

INTEGRATED RESOURCE PLAN (IRP) 2022


Mitigations

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<th>Current Trends</th>
<th>Decarbonization</th>
<th>No Environmental</th>
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<td>T4 129 99 183</td>
<td>T5 128 98</td>
<td>T6 129 98 183</td>
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<tr>
<td>inverters (MW)</td>
<td>T7 49 128 98</td>
<td>T8 129 98</td>
<td>T9 123</td>
<td>T10 164</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T11 128 99</td>
<td>T12 123</td>
<td>T13 164</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T14 128 98</td>
<td>T15 123</td>
<td>T16 128</td>
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<td>T17 98</td>
<td>T18 123</td>
<td>T19 123</td>
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<td>T20 123</td>
<td>T21 123</td>
<td>T22 123</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T23 123</td>
<td>T24 123</td>
<td></td>
</tr>
<tr>
<td>Additional Synchronous Condensers (MVA)</td>
<td>1250 1500 1900 2700 2700 2050</td>
<td>0 0 350 300 1500 0</td>
<td>0 0 100 200 1100 0</td>
<td>0 0 0 0 0</td>
</tr>
<tr>
<td>Additional Power Mitigations (MW)</td>
<td>323 322 178 123 123</td>
<td>123 123</td>
<td>164 298</td>
<td>326 183 49</td>
</tr>
<tr>
<td>Increased Freq Regulation</td>
<td>90 97 97 105 105</td>
<td>101 39 48</td>
<td>49 45</td>
<td>46 66</td>
</tr>
<tr>
<td>Address Inertial Response Gaps</td>
<td>124 93 178 123 123</td>
<td>123 123</td>
<td>164 129</td>
<td>99 183</td>
</tr>
<tr>
<td>Address Primary Response Gaps</td>
<td>323 322 0 0 0 117</td>
<td>298 326</td>
<td>0 325</td>
<td>0 325</td>
</tr>
<tr>
<td>Firm up Intermittent Renewable</td>
<td>94 138 0 0 0 0</td>
<td>0 0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
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</table>

Note: T represents different scenarios or time periods.
IRP Acronyms

Note: A glossary of acronyms with definitions is available at https://www.aesindiana.com/integrated-resource-plan.
IRP Acronyms

- ACEE: The American Council for an Energy-Efficient Economy
- AMI: Advanced Metering Infrastructure
- AD: Ad Valorem
- AD/CVD: Antidumping and Countervailing Duties
- ADMS: Advanced Distribution Management System
- BESS: Battery Energy Storage System
- BNEF: Bloomberg New Energy Finance
- BTA: Build-Transfer Agreement
- BTU: British Thermal Unit
- C&I: Commercial and Industrial
- CAA: Clean Air Act
- CAGR: Compound Annual Growth Rate
- CCGT: Combined Cycle Gas Turbines
- CCP: Coal Combustion Products
- CCS: Carbon Dioxide Capture and Storage
- CDD: Cooling Degree Day
- CIS: Customer Integrated System
- COD: Commercial Operation Date
- CONE: Cost of New Entry
- CP: Coincident Peak
- CPCN: Certificate of Public Convenience and Necessity
- CT: Combustion Turbine
- CVD: Countervailing Duties
- CVR: Conservation Voltage Reduction
- DER: Distributed Energy Resource
- DERA: Distributed Energy Resource Aggregation
- DERMS: Distributed Energy Resource Management System
- DG: Distributed Generation
- DGPV: Distributed Generation Photovoltaic System
- DLC: Direct Load Control
- DOC: U.S. Department of Commerce
- DOE: U.S. Department of Energy
- DR: Demand Response
- DRR: Demand Response Resource
- DSM: Demand-Side Management
- DMS: Distribution Management System
- DSP: Distribution System Planning
- EE: Energy Efficiency
- EFORd: Equivalent Forced Outage Rate Demand
- EIA: Energy Information Administration
- ELCC: Effective Load Carrying Capability
- EM&V: Evaluation Measurement and Verification
- ESCR: Effective Short Circuit Ratio
- ESPT: Energy Storage Planning Tool
- EV: Electric Vehicle
- FLOC: Functional Location
- FTE: Full-Time Employee
- GDP: Gross Domestic Product
- GFL: Grid-Following System
- GFM: Grid-Forming System
- GIS: Geographic Information System
- GT: Gas Turbine
- HDD: Heating Degree Day
- HVAC: Heating, Ventilation, and Air Conditioning
- IAC: Indiana Administrative Code
- IBR: Inverter-Based Resource
- IC: Indiana Code
- ICE: Intercontinental Exchange
- ICAP: Installed Capacity
IRP Acronyms

IEEE: Institute of Electrical and Electronics Engineers
IRA: Inflation Reduction Act
IRP: Integrated Resource Plan
ICE: Internal Combustion Engine
IQW: Income Qualified Weatherization
ITC: Investment Tax Credit
IURC: Indiana Regulatory Commission
kW: Kilowatt
kWh: Kilowatt-Hour
Li-ion: Lithium-ion
MATS: Mercury and Air Toxics Standards
MaxGen: Maximum Generation
MDMS: Meter Data Management System
MISO: Midcontinent Independent System Operator
MMGAL: One Million Gallons
MMTons: One Million Metric Tons
MPS: Market Potential Study
MS: Millisecond
MVA: Mega Volt Ampere
MW: Megawatt
Nat Gas: Natural Gas
NDA: Nondisclosure Agreement
NOX: Nitrogen Oxides
NPV: Net Present Value
NREL: National Renewable Energy Laboratory
NTG: Net to Gross
OMS: Outage Management System
PLL: Phase-Locked Loop
PPA: Power Purchase Agreement
PRA: Planning Resource Auction
PSSE: Power System Simulator for Engineering
PTC: Renewable Electricity Production Tax Credit
PRMR: Planning Reserve Margin Requirement
PV: Photovoltaic
PVRR: Present Value Revenue Requirement
PY: Planning Year
RA: Resource Adequacy
RAN: Resource Availability and Need
RAP: Realistic Achievable Potential
RCx: Retrocommissioning
REC: Renewable Energy Credit
REP: Renewable Energy Production
RFP: Request for Proposals
RIIA: MISO’s Renewable Integration Impact Assessment
RPS: Renewable Portfolio Standard
SCADA: Supervisory Control and Data Acquisition
RTO: Regional Transmission Organization
SAC: MISO’s Seasonal Accredited Capacity
SAE: Small Area Estimation
SCR: Selective Catalytic Reduction System
SEM: Strategic Energy Management
SO2: Sulfur Dioxide
SMR: Small Modular Reactors
ST: Steam Turbine
SUFG: State Utility Forecasting Group
T&D: Transmission and Distribution
TOU: Time-of-Use
UCT: Utility Cost Test
UCAP: Unforced Capacity
VAR: Volt-Amp Reactive
VPN: Virtual Private Network
WTP: Willingness to Participate
XEFORd: Equivalent Forced Outage Rate Demand excluding causes of outages that are outside management control